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SAN FRANCISCO ENERGY COMPANY

Steam Pipeline Assessment

APPLICATION FOR CERTIFICATION

January 20, 1995

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Steam Pipeline Assessment
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Steam Pipeline Assessment

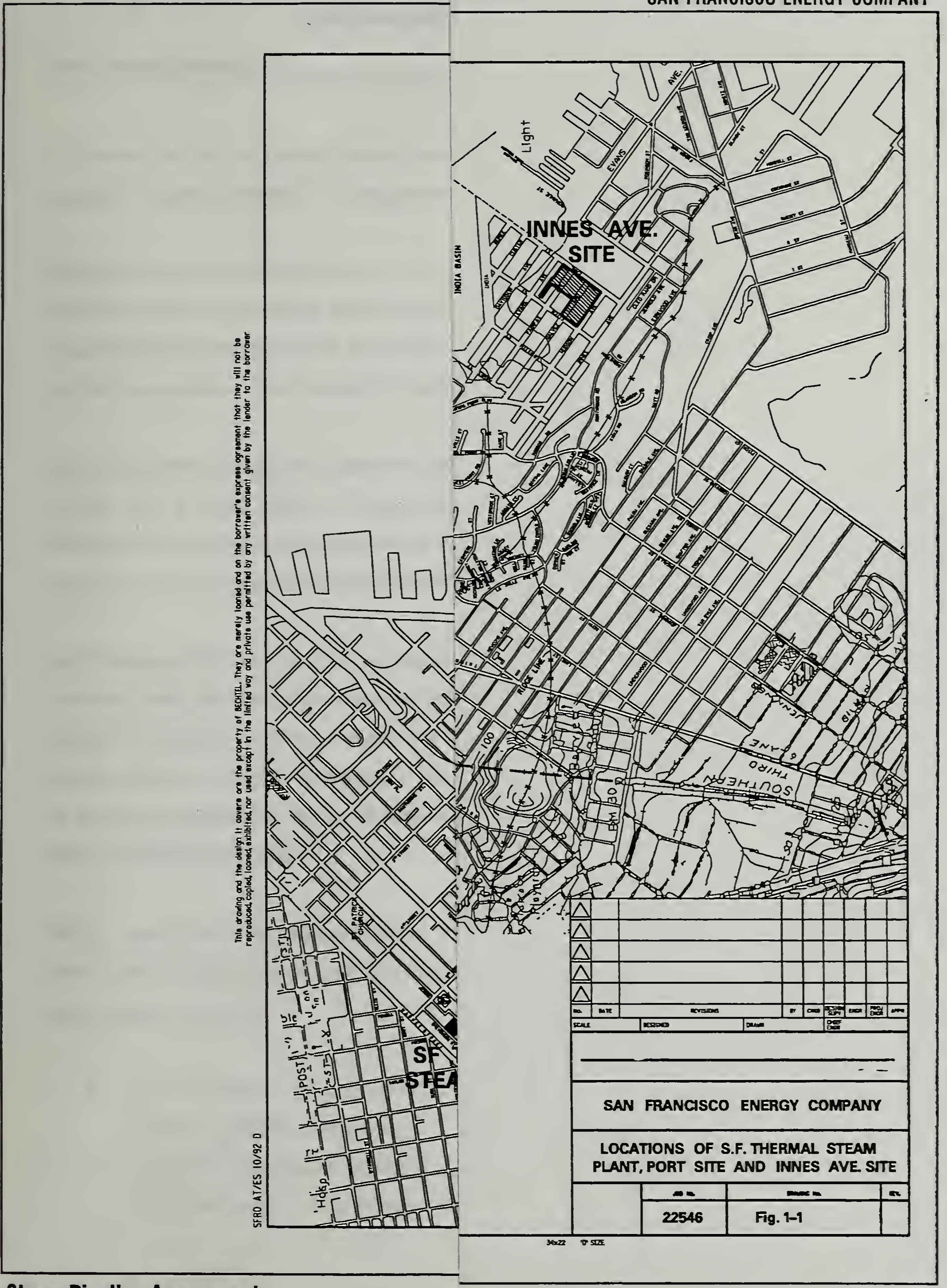
1.0 INTRODUCTION AND SUMMARY

1.1 Project Description

San Francisco Energy Company (SF Energy) has signed a Letter of Intent with San Francisco Thermal, L.P (SF Thermal) to provide steam to SF Thermal's district energy system in San Francisco. SF Thermal's primary steam plant is located at 460 Jessie Street in the vicinity of Market Street, between 5th and 6th streets. In order to transport the steam to SF Thermal's district energy system, SF Energy will construct a new steam pipeline from either the Port Site or the Innes Avenue Site to the SF Thermal steam plant at 6th and Jessie streets. The locations of the proposed facility sites and the SF Thermal steam plant are shown in Figure 1-1.

Steam heating has been part of San Francisco's energy picture since the early 1900s. PG&E entered the business in 1911 and acquired the three steam electric plants of Great Western Power Company in 1930. In 1984, under PG&E, the system was reorganized into a separate department. The new management focused on improving operations, replacing parts of the distribution system and making recommendations for the future of the business. Between 1984 and 1989, operating efficiency improved over 10 percent and unscheduled outages were eliminated. In the same period of time, centralized management efforts caused sales to grow by more than 36 percent.

Also during this time, inquiries regarding the possible sale of the system were received. After extensive analysis and study, PG&E determined that its long-range plans would best be served


INNES AVE. SITE
SF STEA
INDIA BASIN
EVANS
AVE.
Light
THIRD
SOUTHERN
RIDGE LINE
100
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LOCATIONS OF S.F. THERMAL STEAM PLANT, PORT SITE AND INNES AVE. SITE
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Fig. 1-1
34x22 "D" SIZE

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Figure 1-1
Locations of S.F. Thermal Steam Plant, Port Site, and Innes Ave. Site

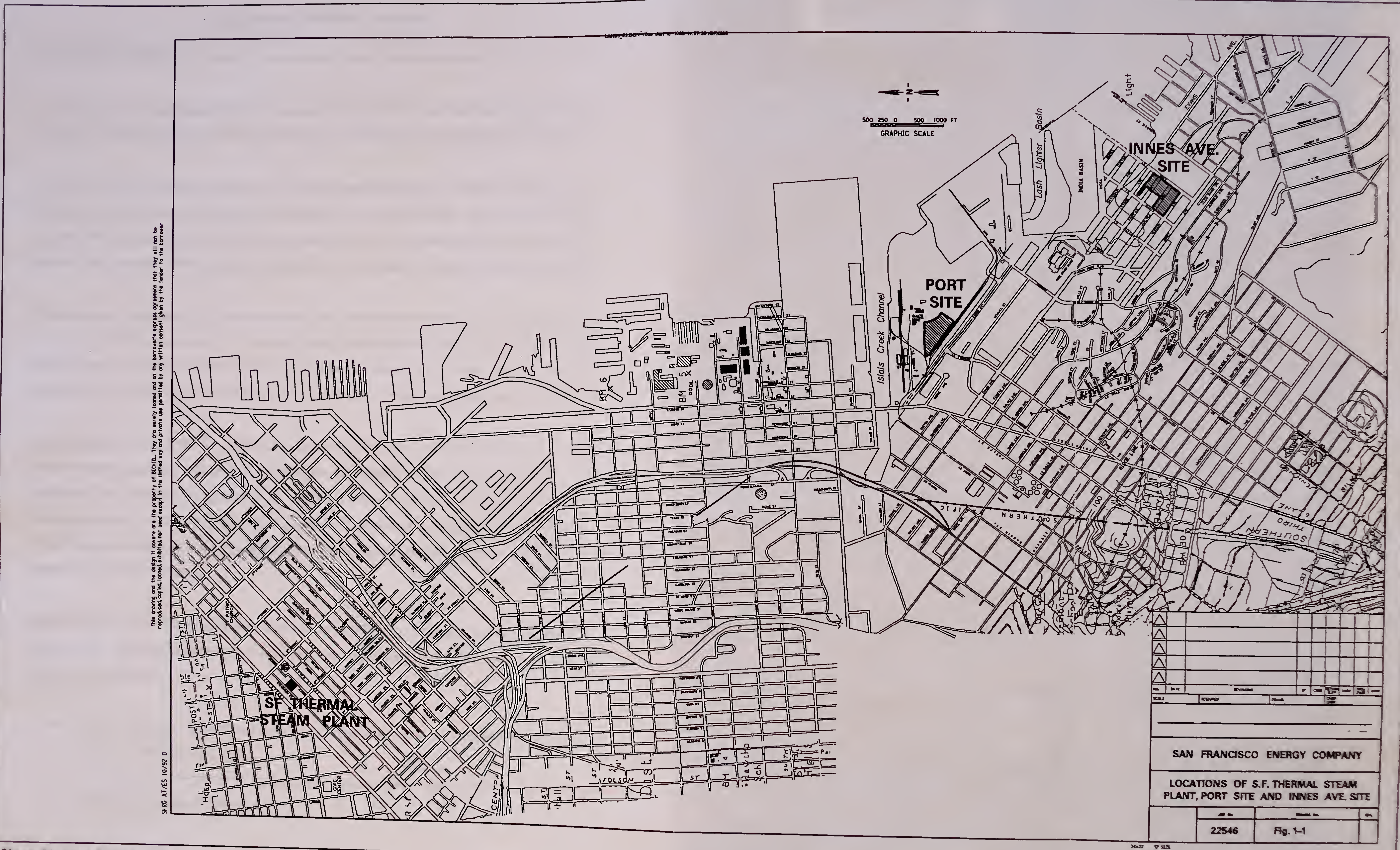
INNES AVE. SITE
PORT SITE
SF THERMAL STEAM PLANT
Islais Creek Channel
Lash Lighter Basin
INDIA BASIN
GRAPHIC SCALE
500 250 0 500 1000 FT
SOUTHERN PACIFIC
THIRD
POST
FOLSOM
CIVIC CENTER
SAN FRANCISCO ENERGY COMPANY
LOCATIONS OF S.F. THERMAL STEAM PLANT, PORT SITE AND INNES AVE. SITE
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Fig. 1-1
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Figure 1-1
Locations of S.F. Thermal Steam Plant, Port Site, and Innes Ave. Site

by focusing on its core gas and electric business, and decided to sell the steam district heating system to Thermal Ventures of Youngstown, Ohio. The sale was completed in June 1993.

Today, the existing system consists of two natural gas-fired plants. Steam is produced at 125 pounds per square inch and is distributed through 11.2 miles of mains. One of the two plants operates 365 days per year, with the smaller plant being used for peak demand during the winter and for emergencies. The business is regulated by the California Public Utilities Commission.

The system serves about 200 customers through an interconnected network of mains that vary in size from 2 to 20 inches. Customers, mostly commercial, range from small cleaning establishments to large commercial office buildings and hotels of all sizes. One of the newer customers is the recently expanded Moscone Convention Center and Performing Arts Center.

San Francisco Thermal, the local operating company, is owned by Thermal Ventures, which owns two other operating companies in Pittsburgh, Pennsylvania, and Youngstown, Ohio. San Francisco Thermal's business plan calls for continued improvements in reliability and continued customer growth. Continued growth of the system benefits both existing and future customers by utilizing economies of scale, by helping to keep long-term prices stable, and by installing better fuel efficiency devices.

District steam is available to customers at consistent conditions of temperature and pressure 24 hours a day. This steam is ready for instantaneous conversion to suit the customer's various energy needs, such as:

- Space Heating. Overall ownership and operating costs are reduced where district steam is available and used.
- Domestic Hot Water Heating. District steam offers rapid recovery rates and an unlimited source of hot water.

- Absorption Air-Conditioning. Some customers incorporate absorption air-conditioning into their building heating, ventilation, and air-conditioning system to meet all or a portion of their space cooling needs. This allows them to reduce the on-peak electricity requirements and associated demand charges when air-conditioning is required. Absorption air-conditioning does not use global warming gases such as chlorofluorocarbons.
- Commercial Processes. Many processes require the direct application of steam. Examples include various uses by restaurants, hospitals, hotels, laundries, and dry cleaners. District steam meets these needs flexibly and reliably. District steam also permits immediate adjustment of delivered steam volume without costly changes in installed boiler capacity.

The SF Energy cogeneration facility will provide a major portion of SF Thermal's annual steam needs with significant environmental benefits. These benefits are in the form of reduced air emissions and recycled water from a state-of-the-art cogeneration facility.

The exported steam from the SF Energy facility will be conveyed by means of an insulated 12-to 16-inch-diameter pipeline to be located as much as possible within existing street rights-of-way. Steam pressure and temperature conditions at sendout from SF Energy are anticipated to be 205 psig and 404°F.

Steam flow to the SF Thermal district heating system will average 85,000 pounds per hour (lb/hr), with the peak anticipated to be 125,000 lb/hr. Annually, SF Energy will deliver 700 million pounds of steam to the SF Thermal system. None of this exported steam will be returned as condensate to SF Energy's facility.

The steam exported to SF Thermal is expected to satisfy SF Energy's requirements for Qualifying Facility (QF) status under PURPA. SF Energy's efficiency is expected to be at least 47 percent under conservative assumptions, which exceeds the PURPA efficiency standard of

45 percent. SF Energy expects an operating efficiency of over 11 percent, which far exceeds the PURPA operating standard of 5 percent. Detailed QF calculations and a heat balance are included as Appendix A.

SF Energy will receive secondary effluent from the Southeast WPCP and treat it for use at the facility. Water treatment systems at the SF Energy facility will be sized to accommodate the quantities of steam exported to (but not returned from) SF Thermal.

SF Thermal is a better steam host than the wastewater evaporator because of the significant energy efficiency benefits of district heating and cooling, the reduction in air pollution from SF Thermal's boilers, and the displacement of approximately 8 million gallons per year of potable water by providing steam from recycled water. Also, the Port of San Francisco and the City and County of San Francisco (CCSF) receive additional economic benefits in the form of enhanced rent payments and increased franchise fees, respectively, from the construction and operation of the steam pipeline.

1.1.1 Steam Pipeline Route

The proposed route for the steam pipeline is shown in Figure 1-2. Several criteria were considered in identifying the approximately 4-mile-long proposed steam pipeline route, including:

- Compatibility with other underground utility services within the corridor
- Minimizing disruption to traffic during construction
- Minimizing disruption to commercial and residential neighborhoods along the construction route
- Cost of construction

The origin of the pipeline will be either the Port Site or the Innes Avenue Site. The steam pipeline will follow the same routes as described in the AFC for the water and gas transport lines running between the Southeast WPCP and the two facility sites. These are shown in Figures 1.2-8, 1.2-9, 1.2-10, and 1.2-11 of the AFC. The corridor defined by these routes

extends the potential connection point to the SF Energy facility to a location just north of the Port Site.

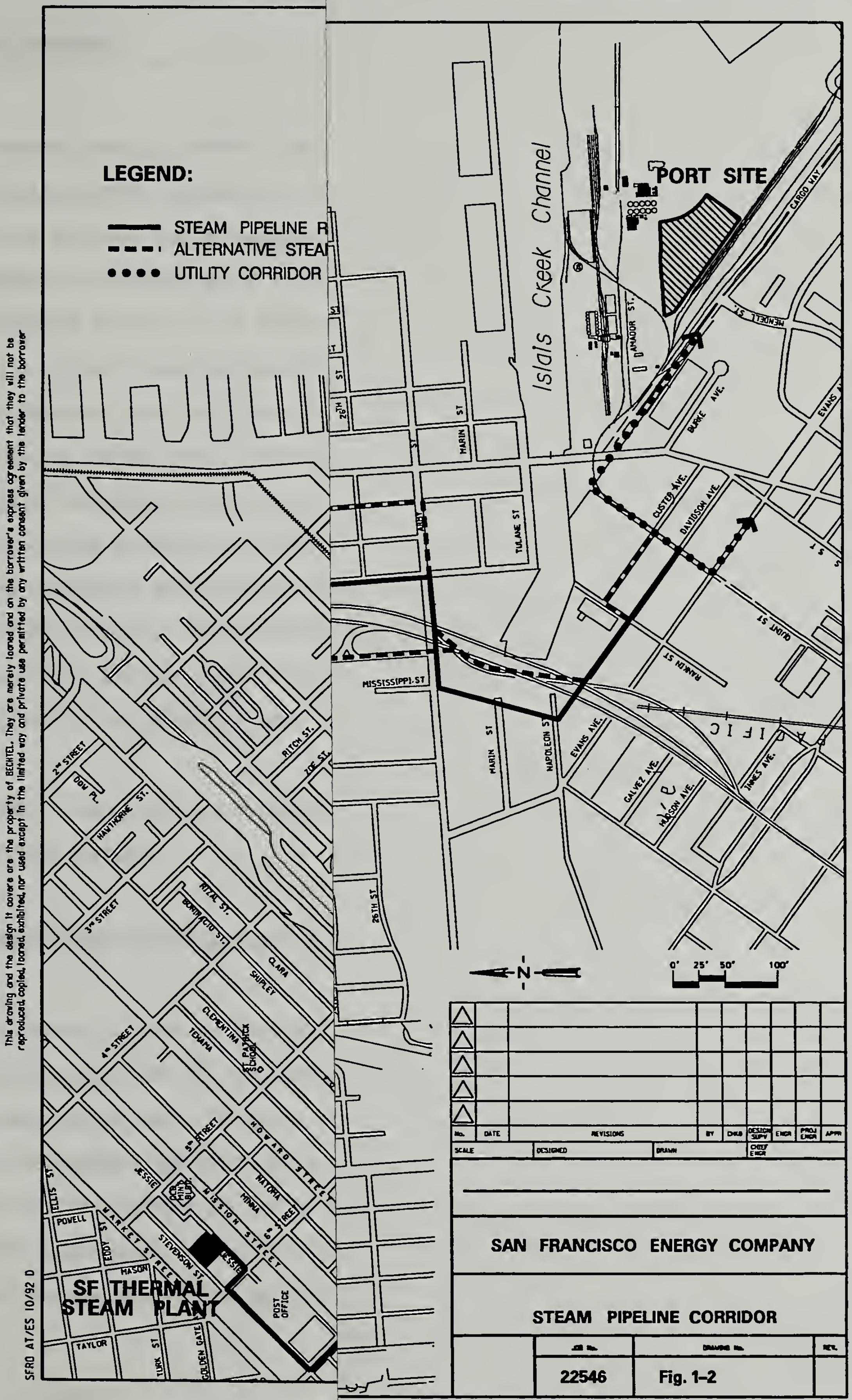
The location of the connection to the SF Thermal district heating system is constrained by the existence of a sufficiently sized steam main to accept the quantity of steam provided by SF Energy. There are currently only two potential locations that have sufficient capacity. They are the main SF Thermal steam plant at 6th and Jessie streets, and at 3rd and Howard streets near Moscone Center. Upon evaluation, a connection to the 3rd and Howard streets location proved undesirable. The route for this connection would run south on 3rd Street, across Mission Creek at China Basin and across Islais Creek near Cargo Way. Crossing both waterways and constructing the pipeline along a major transportation thoroughfare creates unfavorable technical and economic limitations to this routes viability.

The selected route utilizes a connection to the main SF Thermal steam plant at Sixth and Jessie streets. The steam pipeline then runs along the corridor as shown on Figure 1-2. This route proceeds northwest on 6th Street, southwest on Stevenson Street, southeast on 7th Street, east on 16th Street, south on Indiana Street, west on Army Street, south around Islais Creek west of I-280 to Davidson Avenue, southeast on Davidson Avenue, northeast on Quint Street, and southeast on Cargo Way. From that point, the steam pipeline follows the utility corridor to either the Port Site or the Innes Avenue Site as described in the AFC.

1.1.2 Alternative Steam Pipeline Routes

A number of alternative routes within the previously described steam pipeline corridor have been identified. They include:

- Avoiding 16th Street by proceeding south on Mississippi Street and east on Mariposa Street to Indiana Street. While feasible, this route is less desirable due to complications during construction created by the significant grade changes along this route, and a freeway interchange at Mariposa and I-280.


LEGEND:
STEAM PIPELINE R
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UTILITY CORRIDOR
PORT SITE
Islais Creek Channel
CARGO WAY
MENDELL ST.
AMADOR ST.
BURKE AVE.
EVANS AVE.
CUSTER AVE.
DAVIDSON AVE.
QUINT ST
RANKIN ST
MARIN ST
TULANE ST
ARMY
26TH ST
25TH ST
MISSISSIPPI ST
NAPOLEON ST
GALVEZ AVE.
HUDSON AVE.
INNES AVE.
PACIFIC
2nd STREET
DOW PL.
HAWTHORNE ST.
RITCH ST.
ZOE ST.
3rd STREET
RIZAL ST.
BONIFACIO ST.
CLARA
SHIPLEY
CLEMENTINA
TEHAMA
ST. PATRICK SCHOOL
4th STREET
5th STREET
HOWARD STREET
NATOMA
MINNA
6th STREET
MISSION STREET
JESSIE
STEVENSON ST
MARKET STREET
OLD MINT BLDG.
POST OFFICE
ELLIS ST
POWELL
EDDY ST
MASON
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GOLDEN GATE
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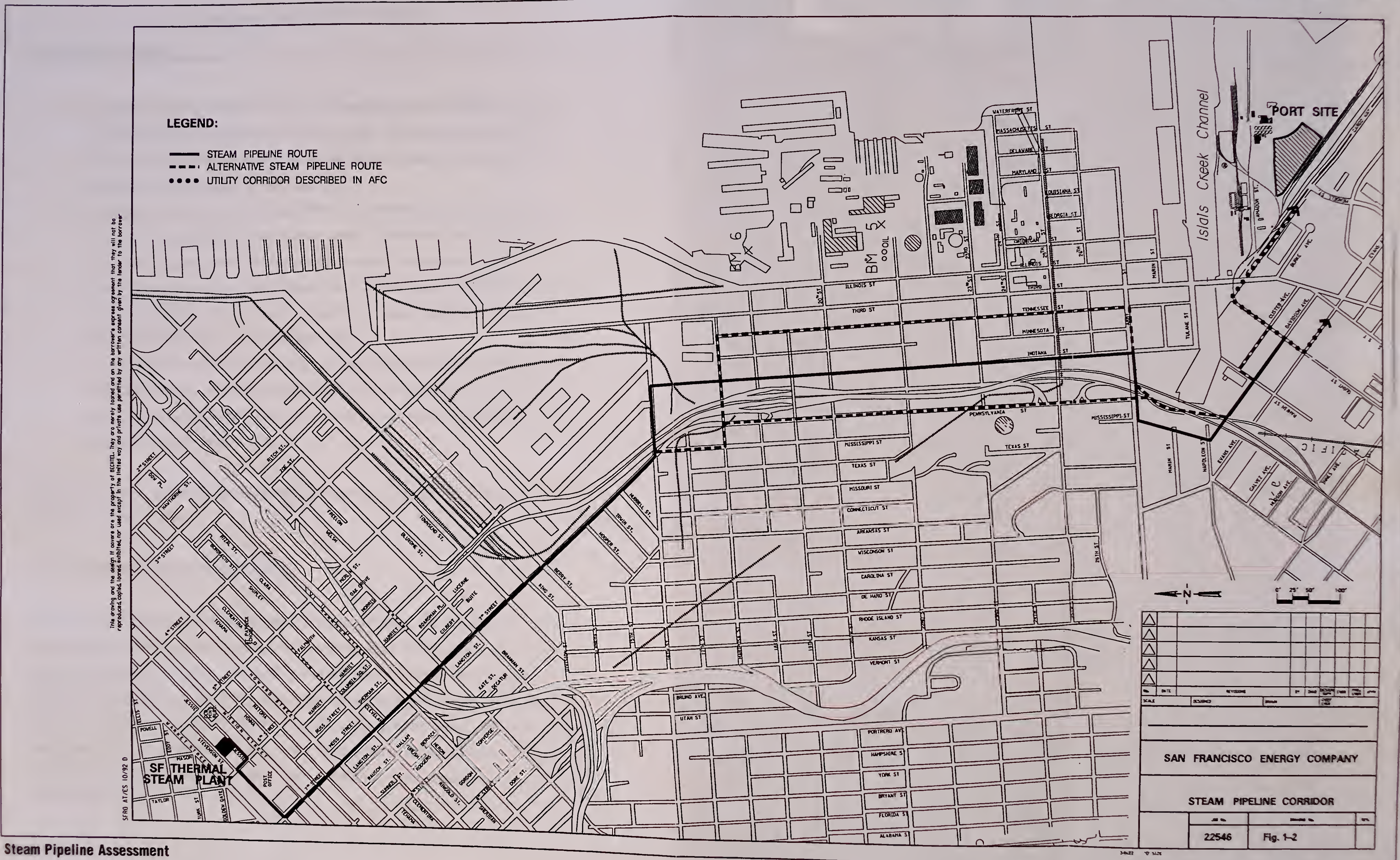
Figure 1-2
Steam Pipeline Corridor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UTILITY CORRIDOR DESCRIBED IN AFC
PORT SITE
Islais Creek Channel
SF THERMAL STEAM PLANT
BM 6
BM 5
OIL
ILLINOIS ST
THIRD ST
TENNESSEE ST
MINNESOTA ST
INDIANA ST
PENNSYLVANIA ST
MISSISSIPPI ST
TEXAS ST
MISSOURI ST
CONNECTICUT ST
ARKANSAS ST
WISCONSIN ST
CAROLINA ST
DE HARO ST
RHODE ISLAND ST
KANSAS ST
VERMONT ST
BRUNO AVE
UTAH ST
PORTRERO AVE
HAMPSHIRE ST
YORK ST
BRYANT ST
FLORIDA ST
ALABAMA ST
WATERFRONT ST
MASSACHUSETTS ST
DELAWARE ST
MARYLAND ST
LOUISIANA ST
GEORGIA ST
MICHIGAN ST
MARIN ST
TULANE ST
NAPOLEON ST
EVANS AVE
GALVEZ AVE
DAVIDSON AVE
CUSTER AVE
BURKE AVE
BERRY ST
KING ST
TOWNSEND ST
BRANNAN ST
7th STREET
HOWARD STREET
MISSION STREET
MARKET STREET
FOLSOM
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STEAM PIPELINE CORRIDOR
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Fig. 1-2
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Figure 1-2
Steam Pipeline Corridor

- Bypassing most of Indiana Street by proceeding east on Mariposa, south on Tennessee Street, and then west on Army Street. This route is also feasible but not as desirable due to impacts on the amount of truck traffic (related to the adjacent warehouses) along Tennessee Street.
- Bypassing most or all of Indiana Street by proceeding south from Mariposa Street to Army Street on Pennsylvania Street. This route is not as desirable as the preferred route due to the residential nature of Pennsylvania Street.
- Traveling around Islais Creek beneath the I-280 overpass within the Southern Pacific Rail Road right-of-way. Potential problems related to the railroad right-of-way make this a less desirable route.
- Passing between Rankin Street and Quint Street along Custer Avenue instead of Davidson Avenue. The abandoned building at the intersection of Rankin Street and Custer Avenue would have to be avoided. As a result, this route is not as desirable as the preferred route.

These alternatives, along with the preferred pipeline route described in Section 1.1, constitute the steam pipeline corridor.

1.2 Assessment Scope and Organization

This study is intended to examine the effect of the construction and operation of the described steam pipeline between either the Port Site or the Innes Avenue Site and the SF Thermal steam plant at 6th and Jessie streets. The scope of this assessment includes that portion of the steam pipeline corridor between the steam plant and the intersection of Custer Avenue and Quint Street. Because of potential effects to traffic along Indiana Street, the study included examination of an additional block east of the steam pipeline route to Tennessee Street. That portion of the pipeline upstream of the Custer Avenue and Quint Street intersection is covered in the AFC.

This study examines the effect of the steam pipeline's construction and operation on the following resources:

- Air Quality
- Biological Resources
- Cultural and Paleontological Resources
- Land Use
- Noise
- Public Health
- Worker Health and Safety
- Socioeconomics
- Traffic and Transportation
- Water Resources
- Engineering Geology and Geologic Resources

1.3 Assessment Summary

1.3.1 Air Quality

An assessment of the effects on air quality created by the steam pipelines construction and operation is included in Section 2.0. Because construction activities are temporary and dust and emission control methods are proposed, the construction of the pipeline will not have significant impacts. The operation of the pipeline will result in positive environmental impacts through the reduction of more than 30 tons per year of pollution from SF Thermal's existing boilers.

1.3.2 Biological Resources

An assessment of the effects on biological resources created by the steam pipeline construction and operation is included in Section 3.0. Because of the urban, developed nature within the

corridor, no significant effect on these resources is anticipated. No special status plant or wildlife species is known to occur within the corridor. If any street trees are removed as part of construction, they will be replaced so that no permanent loss of wildlife habitat occurs.

1.3.3 Cultural and Paleontological Resources

As discussed in Section 4.0, measures are taken during construction of the steam pipeline to avoid impacting any cultural or paleontological resources within the pipeline corridor. Key steps to ensure this include the participation of an archeologist and paleontologist during construction for onsite inspections and review.

As stated in Section 5.3.2.3 of the AFC, the artificial fill and Franciscan basement rock located within the pipeline corridor have a low paleontological sensitivity. The underlying Colma and associated surficial sediments have a higher sensitivity; however, installation of the pipeline should not encounter these sediments. Thus, no impacts on paleontological resources are expected due to the installation and operation of the pipeline.

1.3.4 Land Use

A discussion of land use in the pipeline corridor is included in Section 5.0. The construction and operation of the pipeline would not have any significant impacts on land use within the pipeline corridor. Construction activities are temporary and operation of the pipeline promotes Environmental Protection and Energy Efficiency elements of the Master Plan of the CCSF.

1.3.5 Noise

An assessment of effects on noise levels created by the steam pipeline construction and operation is included in Section 6.0. Because construction activities are temporary and noise control methods are proposed, the construction of the pipeline will not have significant impacts.

1.3.6 Public Health

Public health issues that could be affected by the SF Energy steam pipeline corridor are described in Section 7.0.

During the excavation process, soil contamination will be continually monitored by trained health and safety professionals. Once the steam pipeline is in place and backfilled, and road repair is completed, little or no environmental impact will be realized by the community during its normal operation.

There will not be any airborne pollutants or hazardous materials generated by the steam pipeline during normal operation.

Only steam will be transported through the pipeline. There will be no hazardous materials within the pipeline which could be released as a result of breaks caused by seismic or other impacts.

1.3.7 Worker Health and Safety

An assessment of the effects on worker health and safety issues created by construction and operation of the steam pipeline is included in Section 8.0. With the proposed worker hazard identification, worker safety training, and preventive measures employed to reduce hazards, the steam pipeline's construction and operation minimize risks to worker health and safety.

1.3.8 Socioeconomics

An assessment of socioeconomic effects of the construction and operation of the steam pipeline is included in Section 7.0. Because construction activities are temporary, the construction of the steam pipeline will not have any significant socioeconomic impacts.

1.3.9 Traffic and Transportation

An assessment of the effects on traffic and transportation created by construction and operation of the steam pipeline is included in Section 10.0. With the recommended impact reduction measures, the amount of available roadway is maximized to produce the best level of service possible for any affected roadway segment. Any disruption to traffic flow or transit will be temporary. With the impact reduction measures proposed in Section 10.0, there will be no significant impacts on traffic or transportation from the proposed steam pipeline.

1.3.10 Water Resources

An assessment of the effects on water resources created by the steam pipelines construction and operation is included in Section 11.0.

SF Energy will receive secondary effluent from the Southeast WPCP and treat it for makeup water to the heat recovery steam generator (HRSG). This makeup water will replace both normal blowdown from the HRSG and the quantities of steam that are exported to (but not returned from) SF Thermal. The reclaimed secondary effluent for makeup to SF Thermal's processes represents an environmental benefit in the form of savings in potable water consumption. Every unit of steam delivered by SF Energy will replace steam that is currently generated from potable water by SF Thermal. For an average steam delivery of 85,000 lb/hr, approximately 10,200 gallons per hour of additional demineralized water will be produced by SF Energy from secondary effluent, thereby displacing approximately 245,000 gallons per hour of potable water consumption by SF Thermal, or 80 million gallons per year.

1.3.11 Engineering Geology and Geologic Resources

An assessment of the effects on engineering geology and geologic resources created by the steam pipeline's construction and operation is included in Section 12.0. The proposed line will be

founded in the existing road subgrade materials, or in underlying artificial fill, or on naturally occurring foundation materials.

Geological hazards along the steam pipeline corridor are the same as described in Section 5.14.2.1 of the AFC document. The only geological hazards considered for discussion in this subsection are seismic events causing ground shaking, liquefaction, and, consequently, subsidence and differential settlement. These potential hazards will be addressed during the engineering design in accordance with the appropriate design standard, "Rules Governing the Design, Construction, Testing, Maintenance, and Operation of Utility Gas Gathering, Transmission and Distribution Piping Systems," General Order 112-D, issued by the Public Utilities Commission, State of California.

2.0 AIR QUALITY

The San Francisco Energy Company (SF Energy) facility will supply steam to the San Francisco Thermal Company (SF Thermal). A steam pipeline will be used to interconnect SF Energy and the SF Thermal system. Pipeline installation will require approximately 1 year to complete and will involve excavation, laying of pipe, and backfilling of approximately 4 miles of trench. Figure 1-2 illustrates the pipeline location.

2.1 Affected Environment

The area affected by the construction and operation of the steam pipeline is the same as discussed in the SF Energy AFC.

2.2 Environmental Consequences

2.2.1 Construction

Construction of the pipeline is expected to result in the emissions presented in Table 2-1.

Table 2-1 Summary of Pipeline Construction Emissions

	NO_x	CO	POC	SO_x	PM_{10}
Total Emissions (lb/day)	36.51	22.20	4.92	0.78	8.87
Total Emissions (tpy)	4.56	2.77	0.61	0.10	1.11

Approximately 23,500 cubic yards of soil will be excavated over the 12-month period. The trench for the pipeline will be a maximum of 10 feet deep and approximately 3 feet wide.

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Total Emissions (tpy)	4.56	2.77	0.61	0.10	1.11

Approximately 23,500 cubic yards of soil will be excavated over the 12-month period. The trench for the pipeline will be a maximum of 10 feet deep and approximately 3 feet wide.

The construction activities will occur at different locations along the pipeline corridor; therefore, any localized air quality impact will be temporary.

The construction activities will include excavation of a trench, laying of pipe, welding, and backfilling. Emissions will occur from construction-equipment travel on surface, earthmoving, temporary aggregate piles, and disturbed surface areas. The construction equipment and usage schedule are shown in Table 2-2.

Table 2-2 Construction Equipment and Usage Schedule

Description	Operation
Truck - Gas Pickup	52 vehicle miles traveled per day
Truck - Large Diesel	52 vehicle miles traveled per day
Water Truck	33 vehicle miles traveled per day
Backhoe (70 hp)	6 hours of operation per day
Loader (130 hp)	6 hours of operation per day
Crane (150 hp)	4 hours of operation per day
Diesel Generator (100 hp)	8 hours of operation per day
Welding Machines (75 hp)	8 hours of operation per day
Wind Erosion of Disturbed Surfaces	Construction Area: 1,000 sq. ft. per day Temporary Aggregate Pile: 3,000 sq. ft. per day

To determine the potential worst-case day construction impacts, exhaust and dust emission rates have been evaluated for each source of emissions. Worst-case-day emissions are based on a worst-case operating day and represent the upper bound of emissions that may be expected to occur from the pipeline construction in a day. This day includes maximum vehicle emissions from combustion and dust generation from vehicle travel and material handling. Actual day-to-day emissions are expected to be lower than these estimates.

Annual emissions have been conservatively based on worst-case-day emission rates and a 250 day per year work schedule. Table 2-3 shows the worst-case-day and annual emission rates for the construction of the steam pipeline.

Table 2-3 Pipeline Construction Worst-Case-Day Emissions (lb/day)

	NO_x	CO	POC	SO_x	PM_{10}
Emissions Due to Combustion					
Truck - Gas Pickup	0.12	1.11	0.14	0.01	0.02
Truck - Large Diesel	1.41	1.22	0.29	0.06	0.24
Water Truck	0.89	0.77	0.19	0.04	0.15
Backhoe (70 hp)	6.36	4.28	0.90	0.11	0.66
Loader (130 hp)	10.45	4.87	0.87	0.18	1.31
Crane (150 hp)	3.95	1.61	0.49	0.07	0.55
Diesel Generator (100 hp)	7.62	4.76	1.16	0.17	0.95
Welding Machines (75 hp)	5.71	3.57	0.87	0.13	0.71
Emissions Due to Fugitive Dust					
Material Handling	—	—	—	—	0.04
Vehicle Travel	—	—	—	—	4.08
Construction Area	—	—	—	—	0.07
Temporary Aggregate Pile	—	—	—	—	0.08
Total Emissions (lb/day)	36.51	22.20	4.92	0.78	8.87
Total Emissions (tpy)	4.56	2.77	0.61	0.10	1.11

Attachment A to this section provides detailed emission calculations.

2.2.2 Operation

Table 2-4 shows the emission reductions from SF Thermal boilers as a result of the steam supplied by SF Energy (ref. Cumulative Air Quality Impacts Analysis, San Francisco Energy Company, January 1995).

Table 2-4 Displacement of SF Thermal Boiler Emissions as a Result of the SF Energy Project

Nitrogen Oxides	Carbon Monoxide	Precursor Organic Compounds	Sulfur Dioxide	PM_{10}
16.3 tpy	14.3 tpy	1.2 tpy	0.3 tpy	1.3 tpy

2.2.3 Emission Control Methods

The methods that will be used to control fugitive dust emissions during construction are:

- Prewetting of material (soil) to be excavated.
- Wetting of travel surfaces using a water truck.
- Hose spraying.

Vehicle travel surfaces accessible by water truck will be watered prior to and during construction activities. Hand-held hoses will be used to water areas not accessible to the water truck. Because the excavation activity changes location frequently, the application of water is the most feasible control measure for this activity.

The following methods will be used to control combustion emissions:

- Use of construction equipment operating procedures that act to limit emissions such as equipment maintenance and limiting equipment idling time.

- Use of low-sulfur diesel fuel.
- Use of engines designed for low-NO_x emissions.

2.3 Cumulative Impacts

As a temporary activity, and combined with the proposed emission control methods, the construction of the pipeline will not have any significant impact on air quality. The operation of the pipeline results in a simultaneous reduction of over 30 tons of air pollution from other sources, namely SF Thermal's existing boilers. This is a beneficial cumulative impact from the operation of the pipeline.

2.4 Laws, Ordinances, Regulations, and Standards

As described here and in the AFC, the design, construction, and operation of the proposed pipeline will be in accordance with all applicable federal, state, and local LORS.

2.5 References

References are provided in the AFC.

ATTACHMENT A

EMISSION CALCULATIONS

Emissions Due to Combustion

	Num. Units	Engine Rating, hp	Hours Per Day	Load (1) Factor	Emission Factors (grams/hp-hr)(2) NOx	CO	POC (3)	SOx	PM10	Emission Rates, lb/day NOx	CO	POC (3)	SOx	PM10
Backhoe	1	70	6	0.88	10.10	6.80	1.43	0.18	1.05	6.36	4.28	0.90	0.11	0.66
Loader	1	130	6	0.59	10.30	4.80	0.86	0.18	1.29	10.45	4.87	0.87	0.18	1.31
Crane	1	150	4	0.29	10.30	4.20	1.29	0.18	1.44	3.95	1.61	0.49	0.07	0.55
Diesel Generator	1	100	8	0.54	8.00	5.00	1.22	0.18	1.00	7.62	4.78	1.18	0.17	0.95
Welding Machines	1	75	8	0.54	8.00	5.00	1.22	0.18	1.00	5.71	3.57	0.87	0.13	0.71

	Num. Units	Trips per Veh. per Day	Trip Length 1-way miles	Total VMT/Day	Emission Factors (grams/vmt)(4 NOx	CO	POC (3)	SOx	PM10	Emission Rates, lb/day NOx	CO	POC (3)	SOx	PM10
Trucks - gas pickup	2	5	5	52	1.05	9.64	1.22	0.07	0.21	0.12	1.11	0.14	0.01	0.02
Trucks - large Diesel	2	5	5	52	12.26	10.65	2.55	0.55	2.12	1.41	1.22	0.29	0.06	0.24
Water truck - Diesel	1	8	2	33	12.28	10.65	2.55	0.55	2.12	0.89	0.77	0.19	0.04	0.15
									Total Daily Emissions	36.51	22.20	4.92	0.78	4.81
									Annual Emissions, tpy (5)	4.58	2.77	0.81	0.10	0.58

(1) Energy and Environmental Analysis, Inc. "Feasibility of Controlling Emissions from Off-Road, Heavy Duty Construction Equipment: Attachment to Final Report", 8/88, average load factor for each equipment type.

(2) EPA, "Nonroad Engine and Vehicle Emissions Study", EPA-21A-2001, 11/91, Appendix I, Table I-01(for NOx, CO, and HC). SOx emission factor for Diesel equipment accounts for use of low sulfur fuel (0.05% sulfur).

(3) Includes crankcase and evaporative losses.

(4) BURDEN7F emission factors for 1995 trucks in the San Francisco Air Basin.

(5) Annual emissions are based on 250 working days per year.

Emissions Due to Fugitive Dust

Volume of material excavated, cu yd : 23467
Tonnage of material excavated, tons : 34848
Daily Process Rate, tons per day : 140
Total surface area, ft2 : 63360
Max. length of pipeline installed per day, ft : 85
Max. surface area per day, ft2 : 255

	Daily Process Rate	Process Units	TSP Emission Factor (lb/unit)	TSP Emission Rate (lb/day)	Weight Fraction PM10	Control Eff. (%)	PM10 Emission Rate (lb/day)	Reference Notes
Activity-Material Handling								
Backhoe	140	tons	0.000334	0.05	0.35	0	0.02	1,2
Loader	140	tons	0.000334	0.05	0.35	0	0.02	1,2
Activity- Unpaved Surface Travel								
Backhoe	0.5	VMT	6.81	3.405	0.36	50	0.61	3,4
Loader	0.5	VMT	11.10	5.55	0.36	50	1.00	3,4
Activity- Paved Surface Travel								
Trucks - gas pickup	52	VMT	0.053	2.756	0.34	0	0.94	5
Trucks - large Diesel	52	VMT	0.053	2.756	0.34	0	0.94	5
Water truck - Diesel	33	VMT	0.053	1.749	0.34	0	0.59	5
Wind Erosion								
Construction Area	1000	sq. ft.	0.0014	1.4	0.5	90	0.07	6,7,8
Aggregate Area	3000	sq. ft.	0.0005	1.5	0.5	90	0.08	6,7,8

Total Fugitive Dust, lb/day 4.26

Annual Fugitive Dust, tpy (9) 0.53

Reference Notes:

(1) Material handling emission factor is computed from AP-42, 11.2.3-3 (Aggregate Handling), with 10.5 mph average wind speed (from SF International Airport) and 20% soil moisture content.

(2) Weight fraction of PM10 from "Information for Applying the State Ambient Air Quality Standards for PM10 to the Permitting of New and Modified Stationary Sources", 1/87, CARB.

(3) Unpaved surface travel emission factor is computed from AP-42, 11.2.1 (unpaved roads), 9/88, with a silt content of 68%, 63 days of rainfall (from SF Airport), average weight and vehicle speeds for the loader, backhoe were taken from the Caterpillar Performance Handbook, Ed.20.

(4) A control efficiency of 50% as been assumed for water spray of the unpaved surfaces from "Fugitive Dust Control Technology", J.A. Orlemann, 1983.

(5) Paved road travel emission factor is from AP-42, Table 11.2.5-4 (local streets), 9/85.

(6) Wind erosion dust emission factor computed from EPA's Control of Open Fugitive Dust Sources, 9/88, EPA# 450/3-88-008. A threshold friction velocity of 0.62 m/sec, a roughness height of 0.000166 m for disturbed soil; and a threshold friction velocity of 1.02 m/s; a roughness height of 0.003 m for aggregate piles; and a fastest wind speed of 22.3 m/s.

(7) The PM10 conversion factor for wind erosion from EPA's Control of Open Fugitive Dust Sources, 9/88, EPA#450/3-88-0.008. for PM10 to the Permitting of New and Modified Stationary Sources", 1/87, CARB.

(8) The disturbed area and aggregate pile wind erosion control efficiency is estimated from EPA-450/3-88-008, Section 6.6.1, control of TSP for wetting agent and water applied to storage piles.

(9) Annual emissions are based on 250 working days per year.

3.0 BIOLOGICAL RESOURCES

Biological resources of the pipeline corridor were assessed using information obtained from site visits, existing literature and databases, and individuals knowledgeable about the local area.

3.1 Affected Environment

3.1.1 Existing Habitat

The pipeline corridor is situated along existing city streets and railroad rights-of-way in south and central San Francisco. The corridor is paved or rocked along the entire route and does not cross any open or undisturbed habitat. Commercial and industrial facilities border the entire pipeline corridor. Vehicle traffic varies from light to heavy along streets within the corridor.

3.1.2 Existing Botanical Resources

There are no naturally occurring botanical resources on the pipeline corridor. Planted street trees along the route that could conceivably be affected by project construction include eucalyptus (*Eucalyptus* sp.), cypress (*Cupressus* sp.), coast redwood (*Sequoia sempervirens*), pine (*Pinus* sp.), maidenhair tree (*Ginkgo biloba*), fan palm (*Washingtonia filifera*) and other miscellaneous exotic species. Some of these trees are over 30 feet tall, but most are quite small and restricted in size by adjacent buildings and limited rooting/trunk space at ground level. Occasionally exotic weeds, usually annual grasses, have established in holes in the pavement or rock, but these do not constitute a unique habitat type (Note: plant names follow Hickman, 1993; animal names follow National Geographic Society, 1987).

3.1.3 Existing Aquatic Resources

There are no existing aboveground aquatic resources along the pipeline corridor. The corridor approaches standing water at Islais Creek Channel, but the pipeline is routed around the creek and does not affect any open water (Islais Creek, what there is of it, is entirely contained in underground drainage pipes upland of the Islais Creek Channel section and has not existed as a 'creek' for several decades).

3.1.4 Existing Wildlife Resources

The only wildlife species discovered during surveys of the pipeline corridor were exotic bird species, including rock dove (urban pigeons, *Columba livia*) and house sparrows (*Passer domesticus*). The house sparrows and possibly a few other urban birds (house finch [*Carpodacus mexicanus*], brown-headed cowbird [*Molothrus ater*], and European starling [*Sturnus vulgaris*]) might perch, nest, or roost in some of the street trees that occur along the pipeline corridor. There is no apparent habitat for any other wildlife species.

3.1.5 Species of Special Concern

A search of the California Department of Fish and Game Natural Diversity Data Base for the Hunters Point, San Francisco South, and San Francisco North quadrangle maps produced a list of plant and wildlife special status species. After examination of the pipeline corridor it was determined that none of these species are present and there is no suitable habitat for any special status plant or animal species.

3.2 Environmental Consequences

3.2.1 Construction Impacts

3.2.1.1 Botanical Resources

Pipeline construction could result in the removal of some planted street trees. Following construction, these trees would be replaced with the same species or another commonly used in San Francisco as a street tree.

3.2.1.2 Aquatic Resources

There are no known direct effects of pipeline construction on aquatic resources.

3.2.1.3 Wildlife Resources

Removal of street trees could result in the temporary reduction of perching, nesting, and roosting habitat for a few urban bird species. The restoration and/or replacement of damaged trees after construction will result in no permanent loss of habitat.

3.2.1.4 Species of Special Concern

There are no known effects of pipeline construction on any rare, threatened, or endangered species or species of special concern.

3.2.2 Operation Impacts

3.2.2.1 Botanical Resources

There are no known direct effects of pipeline operation on botanical resources.

3.2.2.2 Aquatic Resources

There are no known direct effects of pipeline operation on aquatic resources.

3.2.2.3 Wildlife Resources

There are no known direct effects of pipeline operation on wildlife resources.

3.2.2.4 Species of Special Concern

There are no known effects of pipeline operation on any rare, threatened, or endangered species or species of special concern.

3.3 Cumulative Impacts

The construction of the pipeline may remove some street trees of various species. The pipeline will avoid complete removal of any trees, if possible. If street trees are removed there will be a temporary reduction in the amount of perching, nesting, and roosting habitat for a few urban bird species. These bird species are very common in the San Francisco Bay Area. Overall, the pipeline does not affect population viability, on a regional basis, of any of the bird species that might occur on the pipeline corridor.

3.4 Laws, Ordinances, Regulations, and Standards

The construction and operation of the steam pipeline will conform to all applicable laws, ordinances, regulations, and standards relative to biological resources. These are described in Section 5.2.4, pages 5.2-17 to 5.2-20, of the AFC.

3.5 References

Hickman, J. C. 1993. *The Jepson Manual - Higher Plants of California*, University of California Press, Berkeley. 1400 p.

National Geographic Society. 1987. *Field Guide to the Birds of North America*, second edition. 464 p.

San Francisco Energy Company AFC. 1994. July.

4.0 CULTURAL AND PALEONTOLOGICAL RESOURCES

SF Energy has signed a Letter of Intent with SF Thermal to provide steam to S.F Thermal's district energy system in San Francisco. SF Energy proposes to construct a new, approximately 3-mile-long, insulated, 12- to 16-inch-diameter steam pipeline running from either the Innes Avenue Site or the Port Site to the SF Thermal primary steam plant at 460 Jessie Street, in the vicinity of 6th and Jessie streets. Whenever possible, the new steam pipeline will be located within existing street rights-of-way (Figure 1-2).

A focused cultural resources archive and literature review for the proposed steam pipeline corridor was conducted with the objectives of identifying recorded or potentially significant cultural properties within and adjacent to the proposed corridor, and providing appropriate management recommendations for resources that may be affected by construction.

A prehistoric and historic site record and literature search was conducted by the Northwest Information Center (NWIC), California Archaeological Site Inventory, Rohnert Park (NWIC File No. 95-8) with an emphasis on the 2-mile-long corridor alignment (and alternatives) from the vicinity of Mariposa and 16th streets to the termination point at the SF Thermal Plant on Jessie Street. Information on the 2-mile-long steam pipeline route from Custer Avenue and Quint Street to Mariposa Street is contained in Section 5.3 (Volume 2) of the Application for Certification (AFC).

In addition to the NWIC search, several cultural resource compliance reports for projects not on file with the NWIC were consulted (see Section 4.5, References).

4.1 Affected Environment

The proposed pipeline will be installed under existing streets at depths between 5 to 10 feet below the present grade in a trench approximately 3 feet wide. Construction impacts will be limited to the excavation of the pipeline trench.

4.1.1 Pipeline Routes

The proposed steam pipeline route and the alternative routes originate at the intersection of Davidson Avenue and Quint Street near the Port Site, in the vicinity of the Islais Creek Channel and the Port of San Francisco Intermodal Container Transfer Facility. The preferred route and alternative routes are described in Section 1.0 and are shown on Figure 1-2.

4.1.2 Cultural Resources

4.1.2.1 Prehistoric

There are no formally recorded prehistoric sites located in or adjacent to the proposed steam pipeline corridor. None of the early Nelson shellmound sites (Moratto 1984:227; Nelson n.d.a, 1909b, see also ca. 1910) are located within or adjacent to the corridor.

4.1.2.2 Ethnographic

No known ethnographic villages, traditional use areas, or sacred resources have been identified within or adjacent to the corridor (Kroeber 1925; Levy 1978; Milliken 1983:72-77, 134, Map 4, 192-193).

4.1.2.3 Historic

National Register of Historic Places. Two National Register-listed historic-era sites are located adjacent to the proposed steam line alignment and alternatives. These include: CA-SFr-42H, the Main Post Office and District Court of Appeals building located at the northeast corner of 7th and Mission streets (Mead 1979 a,b), and the Irving M. Scott School (Potrero School) at 1060 Tennessee Street along the Tennessee Street alternative (see Figure 4-1).

The old U.S. Mint at 88 5th Street (5th and Mission streets), in the vicinity of the steam pipeline termination point, is listed on the National Register and is a National Historic Landmark (Corbett 1974; 1979:76, 223; Cooper 1979; Mead 1979a-b; AASLH/NPS/NCSHPO 1991:68-69) (see Figure 4-1).

City Landmarks. The Baker and Hamilton Building at 700-768 7th Street (Assessor's Block/Lot 3799/1) and the Potrero School (Irving M. Scott School) are City Landmark buildings located along the proposed route and alternative routes (SF 1991) (see Figure 4-1).

Ethnic Groups. Discrete cultural deposits associated with specific historic ethnic groups are not anticipated along the pipeline corridor. Nash (1969, in Chinn et al. 1969) does not illustrate any Chinese fishing villages in the Mission Bay area, but does include a number at Point San Quentin just south of Mission Bay, and at Point Avisadera (Hunter's Point) south of Islais Creek.

4.1.3 Paleontological Resources

The proposed steam pipeline will encounter a number of different geological units along its 4-mile corridor. As shown on the geologic map in Section 12.0 (Figure 12-1), the pipeline will, at ground surface, encounter about 85 percent manmade (artificial) fill, 6 percent undivided

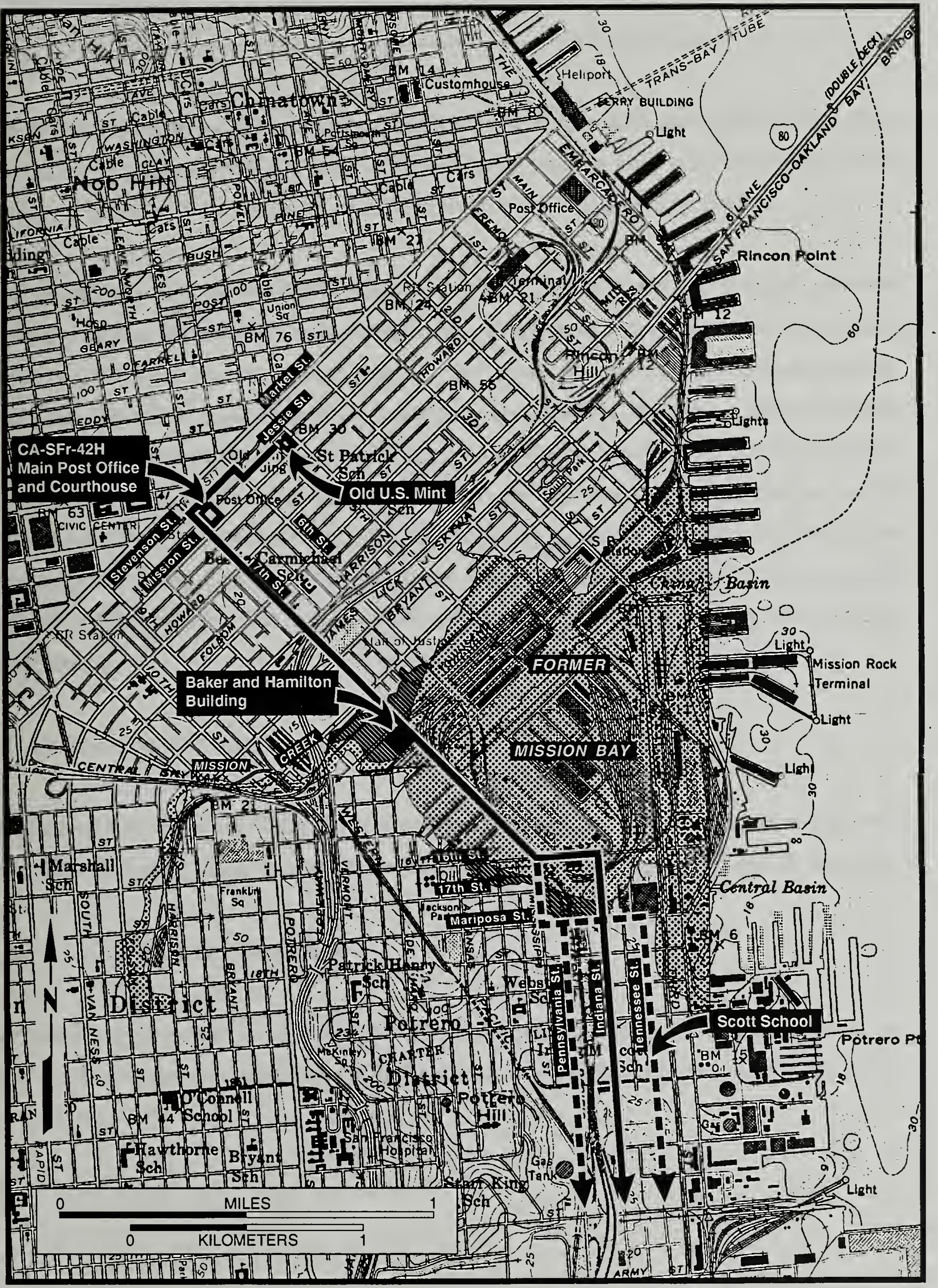
CA-SFr-42H
Main Post Office
and Courthouse
Old U.S. Mint
Baker and Hamilton
Building
Scott School
Market St.
Jessie St.
Stevenson St.
Mission St.
6th St.
7th St.
16th St.
17th St.
Mariposa St.
Pennsylvania St.
Indiana St.
Tennessee St.
FORMER
MISSION BAY
MISSION
CREEK
Chinatown
Nob Hill
Rincon Point
Rincon Hill
China Basin
Central Basin
Mission Rock
Terminal
Potrero Pt
Potrero
District
FERRY BUILDING
TRANS-BAY TUBE
SAN FRANCISCO-OAKLAND BAY BRIDGE
N
0 MILES 1
0 KILOMETERS 1

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Figure 4-1
National Register of Historical Places
and City Landmarks

surficial deposits, 3 percent Franciscan sandstone, 4 percent dune sand, and 2 percent serpentine. The paleontological sensitivity of each of these units or strata is low, with the serpentine unit having a slightly higher potential of containing some microfossils or megafossils.

The integrity of what paleontological resources might be present in the fill, or in the undivided surficial deposits, has been lost because the fossils or fragments thereof have been redeposited during the "filling-in" process in this part of San Francisco. No association (sediment and other fossil material) can be expected in these geological units. There is, however, a slight possibility that fossils may be found in the serpentine unit. As shown on Figure 12-1, both the proposed route and the alternative routes on Tennessee and Pennsylvania streets may encounter serpentine material from 5 to 10 feet below the surface. With the exception of fossils contained in the Franciscan serpentine, no scientifically important fossils are expected along the entire pipeline route from either the Port Site or Innes Avenue Site to the SF Thermal steam plant at 6th and Jessie streets.

4.2 Environmental Consequences

Installation of the proposed steam pipeline will be within existing city street rights of way, with impacts limited to a trenching zone approximately 3 feet wide and between 5 and 10 feet deep.

4.2.1 Historic Land Use Review

The following text provides an overview of historic land use within the steam pipeline area. This text is provided to support the cultural resource recommendations presented at the end of this section.

4.2.1.1 7th Street from Jessie to Mariposa Streets

The street alignments in the project area have remained stable since their survey in the 1850s-1860s. The portion of the pipeline corridor along 7th Street south of Brannan/Townsend streets to about Mariposa Street is on manmade fill within the area of the former Mission Bay (Figure 4-1). In 1852 and 1857, the areas flanking the proposed pipeline alignment consisted of agricultural and undeveloped land, or were situated along the marshy periphery and shoreline of Mission Bay. The bay was filled between ca. 1850-1910 and began with the Folsom Street toll road constructed across the marsh (and 7th Street) on wooden pilings in 1852 (USCGS 1852; USGS 1899; Olmsted 1986:30; Dow 1973:121-122 after Hittell 1882). Initially, sand for fill was secured from the southern shores of Mission Bay but by 1862, sand from the grading of Harrison Street from 3rd Street to 8th Street and later, sand from grading in the general area, was used. Rock from Potrero Hill, garbage, the 1869 2nd Street cut and rubbish, and debris from the 1906 earthquake were among the various sources used for fill (Dow 1973).

A city dump was established in the area of Berry Street between 6th and 7th streets from at least 1878 until 1895 as a bay reclamation measure. Reportedly as many as 300 wagon-loads of household refuse and street sweepings were dumped daily and intensively scavenged for saleable materials (Olmsted et al. [Bayside] 1982:222-224, 231 after San Francisco Daily Evening Post 3/30/1878, San Francisco Call 11/11/1895).

By 1869, numerous buildings were present along the proposed pipeline route and Mission Creek was still a major water feature (USCGS 1869). Prior to 1869, the Southern Pacific Railroad Company (SP) purchased property north of Channel Street between 3rd and 7th streets and to the south of Channel Street between 5th and 7th to 16th streets for a railyard. SP was responsible for the extensive reclamation of Mission Bay and even constructed a seawall (Dow 1973:117-140, Map 10).

As illustrated by the U.S. Coast and Geodetic Survey Maps of 1882 and 1884, 7th Street terminated at the prominent physiographic point where Mission Creek emptied into Mission Bay. At this time, the SP railroad tracks crossed Townsend Street at 7th Street. The in-fill of Channel Street had also begun on the opposite side of the creek, but did not yet extend to 7th Street. On the other side of Mission Bay, Mississippi Street extended almost to 17th Street while a single structure was located at the southwest corner of what was to become Indiana and Mariposa streets (USCGS 1882, 1884). By 1899 7th Street had been extended to Mariposa Street and Mission Bay confined to the area between 4th and 6th streets. Sixteenth Street still did not extend to 7th Street and Indiana Street still terminated at Mariposa (USGS 1899).

Two ships are known to have been sunk in Mission Bay but their exact location is not known. These include the brig Violet, date built unknown, which burned on October 16, 1879, and the 773-ton bark Milan, built in 1847 and owned by Pope and Talbot. This ship was destroyed by an arson fire and sank August 17, 1875 (California [State of] Lands Commission 1/10/95 computer data provided by Goodyear K. Walker after Marshall 1978).

4.2.1.2 16th Street to 22nd Street - Along Pennsylvania, Indiana, and Tennessee Streets

The area, from 16th to 22nd streets, is partially on manmade (artificial) fill resulting from the infilling of Mission Bay from ca. 1850-1910 and within areas cut, filled and graded to produce a level surface. Early land use of the former shoreline appears to be characterized by shipbuilding in the 1860s and 1870s with the industrialization of Potrero Point from 1860 onward, resulting in the development of boardinghouses and other working-men's establishments. Since the early 20th century, structures and businesses have included flats, dwellings, saloons, railroad tracks, ship-building facilities, and other industrial plants and processing facilities (see Wirth Associates 1979:86-98 and references therein).

4.2.1.3 22nd Street to Army Street

This area, once part of the Islais Creek inlet and associated marsh, was gradually filled by 1893. Structures and business were few in the area until the early 20th century. Early structures included a powder magazine at Indiana and 25th streets (formerly the shoreline) with a wharf connecting the magazine to another structure at Illinois and 25th streets (Wirth Associates 1979:96-98).

4.2.1.4 Islais Creek Area (Army Street, Custer Avenue/Quint Street)

Development in this area has occurred slowly and generally over the past 60 years as the reclamation of Islais Creek and its associated saltmarsh was only completed in 1936. Army Street came in during the 1890s and was paved ("macadamized") in 1893. Fill for Army Street may have contained refuse from San Francisco and a 1918 view from 3rd Street shows that the area was used as a garbage dump. One structure was present at Army and Pennsylvania streets in 1900 and a lumber shed is noted in 1929 at Mississippi Street. The majority of general development is post-1940 (Wirth Associates 1979:98-101).

4.3 Recommendations

4.3.1 Cultural Resources

In general, the research conducted for the pipeline corridor (including the alternatives) suggests only a low to moderate potential for significant subsurface cultural resources within the proposed city street right-of-way. This assessment is based on previously recorded resource disturbances due to past placement of varying quantities of fill along major portions of the route to reclaim Mission Bay and its associated marshes and streams, grading and paving operations for street construction, relatively stable street configuration, episodes of utility placement, and debris

removal from the 1906 earthquake and fire. The following recommendations are based on a review of the available archive information.

4.3.1.1 Prehistoric

No known prehistoric resources will be impacted by the project. The likelihood of exposed buried prehistoric shellmounds is a remote possibility. No monitoring is recommended for prehistoric resources.

4.3.1.2 Historic

7th Street between Jessie and Mariposa Streets. Road construction, maintenance, and utility placement have undoubtedly affected this section of the proposed route. Remnants of the Mission Plank Road of 1852 may be extant at the intersection of Mission and 7th streets, in addition to remains of the Folsom Plank Road from 1857/1859. Cultural resources associated with the in-filling of former Mission Bay could also be exposed. However, the 1878-1910 dump in the vicinity of Berry, 6th, and 7th streets was not considered significant by previous researchers due to intensive scavenging at the time of disposal and the lack of depositional integrity. Spot monitoring of the pipeline route by an archaeologist is recommended during construction, with full-time monitoring recommended from Mission Street to termination and in the vicinity of Folsom and 7th streets.

16th to 22nd Streets between Pennsylvania and Tennessee Street. The area is located on partially manmade fill, resulting from the infilling of Mission Bay from ca. 1850- 1910 and areas that were cut, filled, and leveled. Road construction, maintenance, and utility placement have undoubtedly affected this section of the proposed route. Full-time monitoring is recommended between 16th and 20th streets due to the presence of early maritime businesses and residences in this section of the pipeline corridor. Intermittent monitoring, at the discretion of the archaeologist, is recommended between 20th and 22nd streets.

22nd Street to Army Street. This area, once part of the Islais Creek inlet and associated marsh, was gradually filled by 1893. Structures and business were few in the area until the early 20th century. Full-time monitoring is recommended on Indiana Street between 22nd and 25th streets, especially in the vicinity of Indiana and 25th streets at the putative location of a former powder magazine and wharf and at Tennessee and 25th streets, the possible location of the wharf connecting the powder magazine to another structure at Illinois and 25th streets. Intermittent monitoring is recommended on Pennsylvania, Indiana, and Tennessee streets during construction at the discretion of the archaeologist.

Islais Creek Area. Development in this area has occurred slowly and generally over the past 60 years with the majority of the development occurring after 1940. Fill for Army Street may have contained refuse, and a 1918 view from 3rd Street indicates that the area was used as a garbage dump. Full-time monitoring is recommended between Mississippi and Pennsylvania streets due to the potential for turn-of-the-century structures. Spot monitoring is recommended for the remaining portion of this route at the discretion of an archaeologist, with a special emphasis on the former creek and marsh area due to the possibility of buried boats.

4.3.2 Paleontological Resources

Since no large-scale excavations will occur during the installation of the steam pipeline at a depth of 5 to 10 feet below surface within city streets, no continuous paleontological monitoring is necessary. Because of the possibility that serpentine may contain associated fossils at two locations along the pipeline route (see Figure 12-1), a paleontologist should be available during the trenching operation through this geologic unit. Should paleontological resources be found during the trenching activities, the paleontologist should determine their significance and perform appropriate offsite testing.

4.4 Cumulative Impacts

As stated in the previous subsection, no significant impacts are expected on paleontological, prehistoric, or historic cultural resources along the steam pipeline corridor. Since there are no other known construction activities within the steam pipeline corridor, cumulative impacts to these resources are insignificant.

4.5 Laws, Ordinances, Regulations, and Standards

The project will comply with the applicable laws, ordinances, regulations and/or standards referenced in Section 5.3.5 of the AFC.

4.6 References

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5.0 LAND USE

5.1 Affected Environment

5.1.1 Land Uses in Project Vicinity

From the intersection of Cargo Way and Third Street, the proposed steam pipeline corridor passes primarily through industrial zones. Just west of Third Street, the corridor passes the Southeast Booster Pump Station and a small open space area along the south shore of Islais Creek. Along Quint Street and Davidson Avenue, mixed quality industrial and warehousing type uses predominate. An alternative to the Davidson Avenue route is Custer Avenue. It is also mixed industrial and warehousing, but terminates at Rankin Street. West of Rankin Street, the corridor would pass an older industrial building and by an auto parts business and auto junk yard prior to passing under I-280. The corridor would turn north just east of the San Francisco Newspaper Agency warehouse and depot on Marin Street, and then back east toward Indiana Street parallel to the Islais Creek Transport line along the south side of Army Street.

Uses along Indiana Street between Army Street and Mariposa are primarily industrial buildings of varying quality and intensity of use, with a few exceptions. I-280 and the northbound on-ramp parallels the street at 25th Street. The street is relatively wide and traffic flows northbound only. There is one house on the west side of Indiana between 24th and 23rd streets. A Muni bus yard is west of Indiana between 23rd and 22nd streets, and the associated maintenance facility is on the east side of the street. Between 20th and 19th streets, I-280 is to the west and the private Esprit Company Park is on the east side of the street.

At Mariposa, the corridor would either go west on Mariposa between industrial uses and under I-280 to Mississippi Street, or follow through the parking lots of several industrial structures to 16th Street, where it would go west through an industrial area to the corner of 7th Street and

Mississippi. At the corner of Mariposa and Mississippi, there appear to be several housing units above a corner retail establishment. With that exception, land uses remain industrial.

Northbound on 7th Street, uses on the west are industrial buildings, bus yards (Greyhound), and a storage facility. The elevated section of I-280 and the Peninsula Rail corridor are to the east. North of Hooper Street, the elevated freeway curves away to the east, but the railroad tracks continue to parallel 7th Street until approximately Townsend Street, where they curve to the east to the terminal. Between Townsend and Brannan, the corridor passes through the Showplace Square area with retail and wholesale showrooms.

Uses on both sides are industrial with some retail uses until north of Bryant, where 7th Street passes the Hall of Justice and new County Jail on the east side of the street, and the Highway 101 northbound off-ramp and GSA motor pool to the west. Continuing north under Highway 101, 7th Street uses become more mixed approaching Market Street. St Michael's Ukrainian Orthodox Church is on the east side of the street between Harrison and Folsom Streets, and other uses are predominately retail and industrial. Between Folsom and Mission Streets, motels become part of the land use mix. Between Mission Street and Stevenson Street, a vacant lot and vacant building are to the west, and the U.S. Court of Appeals building, presently vacant and undergoing seismic upgrading, is to the east. Following Stevenson Street (a narrow alley) to the east, there are back entrances to a mix of multi-story retail buildings, industrial warehouse type buildings, and empty lots used for parking. The frontage along 6th Street where Stevenson Street crosses it is mostly retail on the ground floor with residential uses on upper floors.

Alternative corridors to Indiana Street include Tennessee Street or Pennsylvania Avenue. Tennessee Street is located one block west of Third Street and two blocks east of Indiana Street. Land uses are primarily industrial, but there are also approximately 65 to 75 housing units in single family and small multi-family buildings, primarily between 18th Street and 23rd Street. A San Francisco Fire Station is located on the east side of Tennessee Street between 19th and 20th Streets.

Besides the proximity of I-280 to the east, Pennsylvania Avenue has primarily industrial frontage between Army Street and 22nd Street. Between 22nd Street and Mariposa Street, residential use predominates, with approximately 175 to 200 housing units in a mix of single-family homes and small (two to four unit) multifamily structures. In addition, the Mission Bay Convalescent Hospital is on the block between 19th and 18th Streets. In contrast to Indiana and Tennessee Streets which skirt the eastern slope of Potrero Hill, Pennsylvania Avenue gains several hundred feet between Army Street and 20th Street, before dropping down toward Mission Bay.

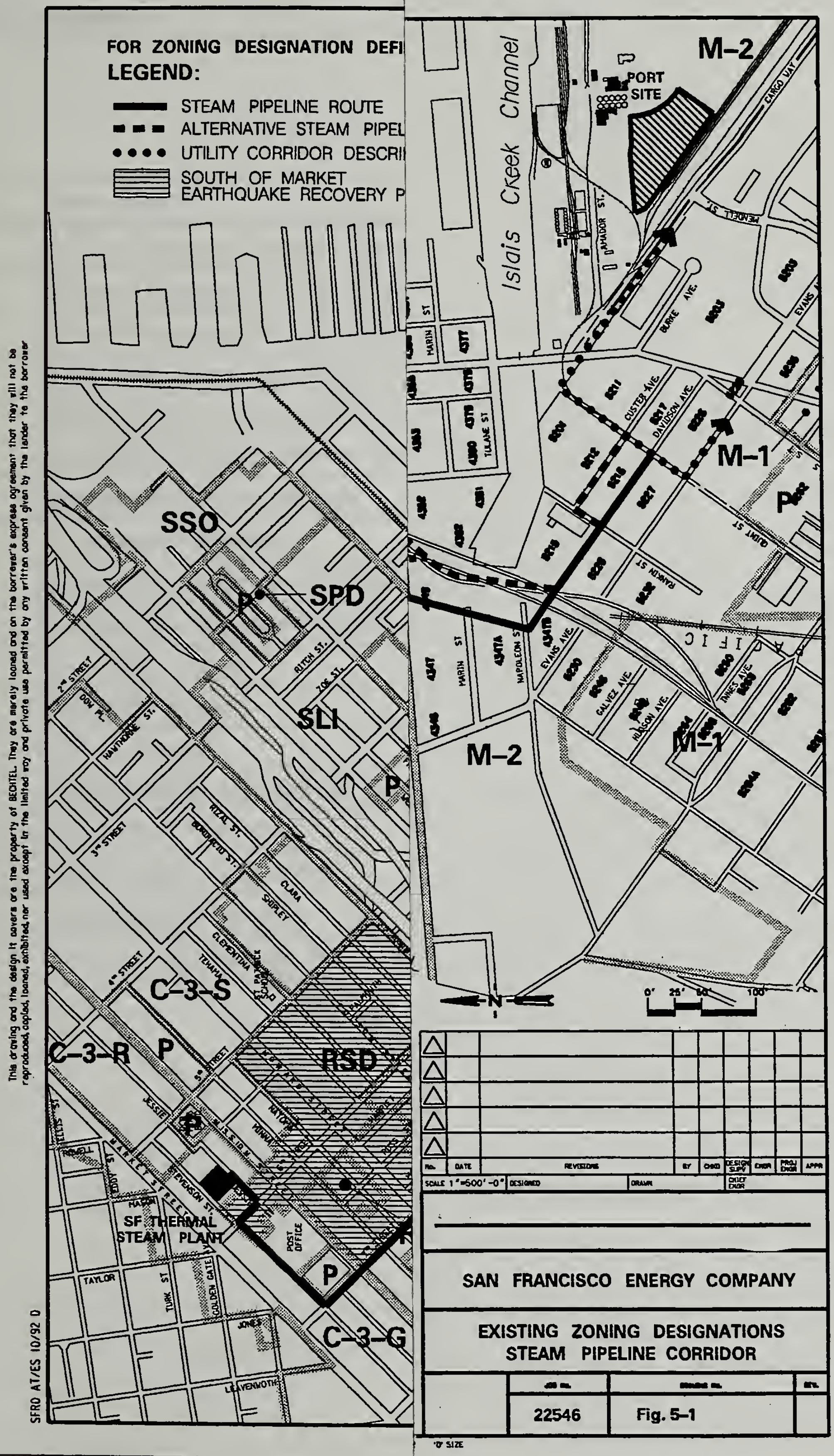
5.1.2 General and Specific Plans, Policies, and Zoning

The proposed pipeline corridor is located entirely within the City and County of San Francisco. As such, the San Francisco Master Plan and its specific area plans, the planning codes, and the zoning maps designate the land use along the corridor. The current zoning surrounding the pipeline corridor is shown on Figure 5-1 and Table 5-1.

The Master Plan contains elements with objectives and policies germane to the proposed steam pipeline connection to the District Steam Plant.

Environmental Protection Element Objective 6 is to "Conserve and Protect the Fresh Water Resource." Policy 2 indicates that the City and County should "investigate the future possibilities of water reclamation, especially for such purposes as fire fighting and industrial use."

Objective 14 of the same element is to "Promote Effective Energy Management Practices to Maintain the Economic Vitality of Commerce and Industry." Policy 5, in encouraging the use of integrated energy systems, indicates that the present system of downtown district heating plants is efficient and that cogeneration and use of waste heat systems should be considered for new projects.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POST OFFICE
CARGO WAY
AMADOR ST.
BURKE AVE.
CUSTER AVE.
DAVIDSON AVE.
EVANS AVE.
GALVEZ AVE.
HUDSON AVE.
INNES AVE.
RANKIN ST
QUINT ST
MARIN ST
TULANE ST
NAPOLEON ST
2nd STREET
3rd STREET
4th STREET
5th STREET
HAWTHORNE ST.
RITCH ST.
ZOE ST.
RIZAL ST.
CLARA
SHIPLEY
CLEMENTINA
TEHAMA
JESSIE
STEVENSON ST.
MARKET STREET
MISSION
TAYLOR
TURK ST
GOLDEN GATE
JONES
LEAVENWORTH
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EXISTING ZONING DESIGNATIONS
STEAM PIPELINE CORRIDOR
22546
Fig. 5–1
SCALE 1"=500'-0"
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Figure 5-1
Existing Zoning Plan

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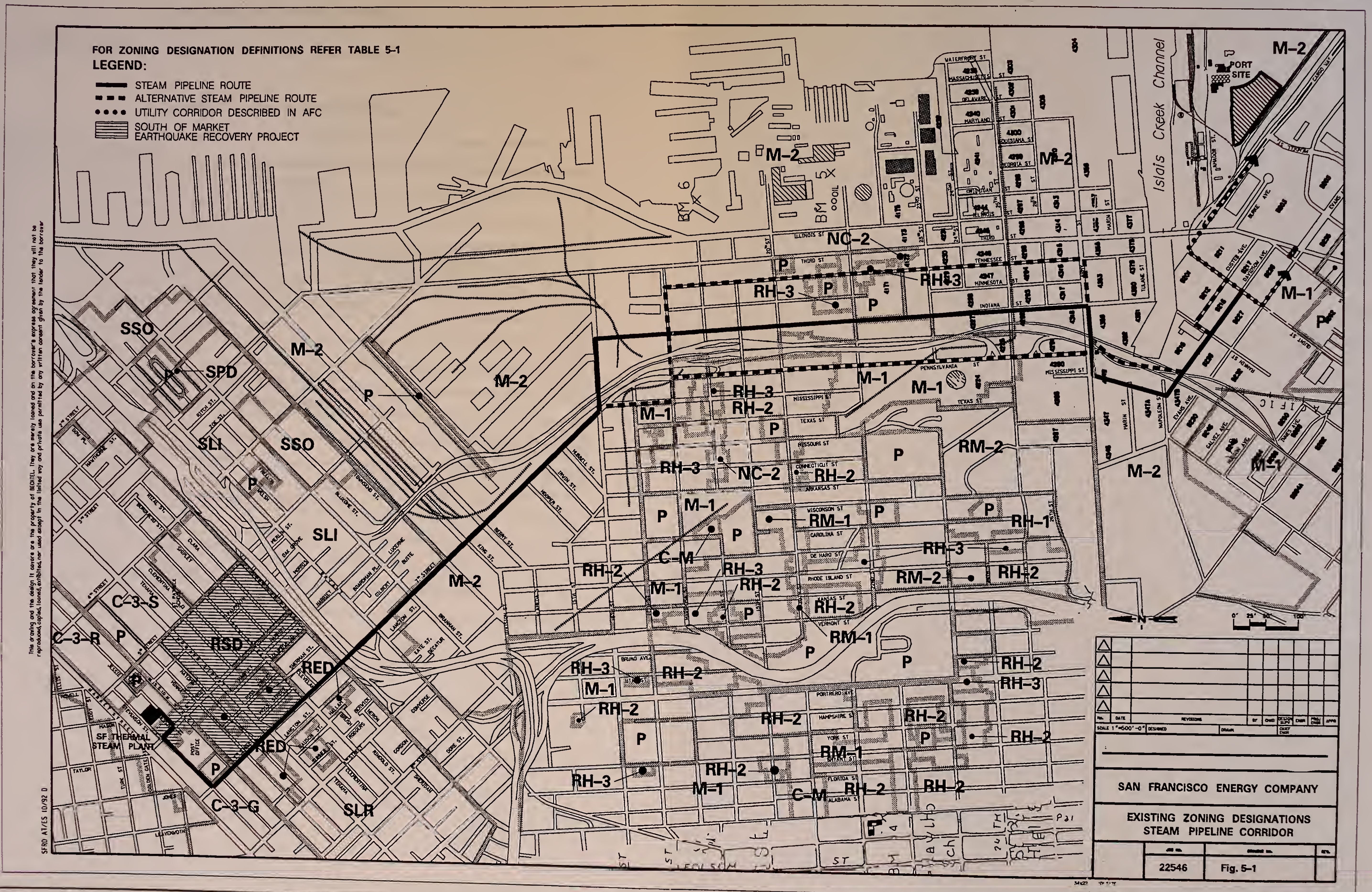
FOR ZONING DESIGNATION DEFINITIONS REFER TABLE 5-1
LEGEND:
STEAM PIPELINE ROUTE
ALTERNATIVE STEAM PIPELINE ROUTE
UTILITY CORRIDOR DESCRIBED IN AFC
SOUTH OF MARKET EARTHQUAKE RECOVERY PROJECT
SSO
SPD
SLI
M-2
P
RSD
RED
C-3-S
C-3-R
C-3-G
SLR
SF THERMAL STEAM PLANT
M-1
RH-1
RH-2
RH-3
NC-2
C-M
RM-1
RM-2
PORT SITE
Islais Creek Channel
SAN FRANCISCO ENERGY COMPANY
EXISTING ZONING DESIGNATIONS STEAM PIPELINE CORRIDOR
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Fig. 5-1
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Figure 5-1
Existing Zoning Plan

Table 5-1 Description of Zoning

Zone No.	Description
RH-1	House Character Districts (Residential)
RH-2	House Character Districts (Residential)
RH-3	House Character Districts (Residential)
RM-1	Mixed House and Apartment Character Districts (Residential)
RM-2	Mixed House and Apartment Character Districts (Residential)
RED	Residential Enclave District (South of Market)
RSD	Residential/Service District
C-M	Commercial Districts
C-3-O	Commercial Districts (Downtown Office)
C-3-R	Commercial Districts (Downtown Retail)
M-1	Industrial District
M-2	Industrial District
P	Public District
NC-2	Neighborhood Commercial District
SPD	South Park District
SSO	Service/Secondary Office
SLI	Service/Light Industry
SLR	Service/Light Industry/Residential

From south to north the proposed pipeline route traverses four of the planning areas with the following Master Plan land use designations along the right of way:

a) South Bayshore Area Plan. Plan designation of industrial and zoning designation of M-2.

b) Central Waterfront Area Plan. For the primary route, the plan designation is industrial and zoning is primarily M-2. The exception is along Indiana Street between 23rd and 22nd Streets where the block to the west is designated M-1 and most of the block to the east is designated P, Public District, reflecting the Muni Maintenance Base location.

c) South of Market Area Plan. South of Harrison Street, the area along 7th Street is designated Retail/Business Service/Industrial with low income housing a conditional use. The one exception is the Hall of Justice Legal Service Office District located south of the Hall of Justice on Bryant Street. Between Harrison Street, and Mission Street, the area is designated Residential/Retail/Business Service/Light Industrial. The zoning categories of SLI (service/light industry) and SLR (service/light industrial/residential) also reflect the mixed uses in much of the South of Market area. South of Stevenson Street, the area on either side of 6th Street is designated RSD (residential/service district).

d) Downtown Area Plan. The area north of Mission Street to and across Market Street is designated for Downtown General Commercial use and the corresponding zoning district is C-3-G, a general commercial district.

5.1.3 Redevelopment Agency Plans

The only redevelopment project adjacent to the proposed corridor is the South of Market Earthquake Recovery Project (see Figure 5-1), which is bounded on the west by 7th Street between Folsom Street and Mission Street, and also follows 6th Street north to Stevenson Street. The primary purposes of this redevelopment project are to rehabilitate housing, develop new

housing, and economic/employment development through commercial rehabilitation and financial and technical assistance. Several housing opportunity sites are identified along 7th Street in the plan.

5.1.4 Planned Developments in the Vicinity

The major development planned in the vicinity of the proposed pipeline route is the Mission Bay project. The approximate boundaries of Mission Bay are north of Mariposa, east of 7th Street, and south of Townsend Street. The proposed pipeline alignment would go through the designated industrial zone between Mariposa and 16th Street, and then be separated from the development along 7th Street by the presence of the elevated I-280 freeway. Between Mission Creek and Townsend, the pipeline right of way would pass along the boundary of the proposed development.

5.2 Environmental Consequences

5.2.1 Compatibility with Surrounding Land Uses

The pipeline right-of-way would not impact any buildings. If Davidson Avenue were unavailable and the pipeline had to follow Custer Avenue past Rankin Street, then it would probably be necessary to remove a section of the unused concrete and brick industrial building at the intersection of Rankin Street and Custer Avenue.

For the remainder of the right-of-way, the only land use impact would be constrained access to properties during the construction period, anticipated to last approximately 5 to 10 days for any given block. Access would be restricted during the excavation process, during the installation of the pipe, and during the backfilling and repaving process. At other times between these activities, access to parcels could be maintained by temporary use of steel plates.

5.2.2 General Plan and Zoning Conformity

The proposed project would be consistent with policies and objectives of the San Francisco Master Plan. The Zoning Ordinance does not have any requirements that would be violated by an underground pipeline.

5.2.3 Consistency with other Plans

Construction of the pipeline would not be inconsistent with the Redevelopment Agency South of Market Earthquake Recovery Project.

5.3 Cumulative Impacts

Construction of the pipeline would not have any cumulative impact on the proposed Mission Bay Project. Although not planned at this time, it might be possible to provide steam power to proposed new buildings in the Mission Bay area. While also not planned at this time, it might be possible to utilize the same trench for a line to supply reclaimed water from the cogeneration plant to the Mission Bay neighborhood for landscape irrigation.

5.4 Laws, Ordinances, Regulations, and Standards

As addressed here and in Section 5.4 of the AFC, the proposed project will be designed, constructed, and operated in accordance with all relevant federal, state, and local LORS.

5.5 References

For references, refer to the SF Energy AFC (Land Use, Section 5.4).

6.0 NOISE

This section addresses potential noise emissions from construction and operation of the steam pipeline, as well as the measures to limit such noise emissions and mitigate any impacts.

Applicable noise regulations and sensitive noise receptor locations have been identified. Ambient noise measurements were made at selected locations within the pipeline corridor to define the existing noise characteristics of the area. Computer modeling of the noise sources was carried out to predict the noise levels at the nearby sensitive receptor locations and to determine the noise reduction and mitigation measures needed to be in compliance with applicable regulations.

6.1 Affected Environment

6.1.1 Land Use Characteristics

The steam pipeline runs through the neighborhoods generally known as South of Market, Potrero Hill, and Bayview Hunters Point as shown on Figure 6-1. This area is served by two freeways, U.S. Highway 101 and Interstate Highway 280. Secondary arteries near the pipeline route include Third Street, Army Street, Seventh Street, Eighth Street, Bryant Street, Harrison Street, Mission Street, and Market Street. Running parallel to Highway 101 is a railroad operated by the Southern Pacific Transportation Company. This railroad is also used by CalTrain to provide commuter service for the peninsula. San Francisco International Airport is about 6 miles to the south, and Oakland International Airport is about 7 miles to the southeast. Flyover noises from commercial airliners approaching or departing from these airports are regularly heard in the project area.

6.1.2 Sensitive Noise Receptors

The areas traversed by the pipeline corridor are zoned mostly as Industrial, Public, Service/Light Industrial/Residential (SLR), or Residential/Service Districts, as shown on Figure 6-1. The corridor crosses an SLR district. Theh alternative routes on Tennessee and Pennsylvania streets cross one or two House Character Districts. An inspection of the corridor revealed the existence of several isolated residences in nonresidential districts. The selection of noise measurement locations has taken these residences into account.

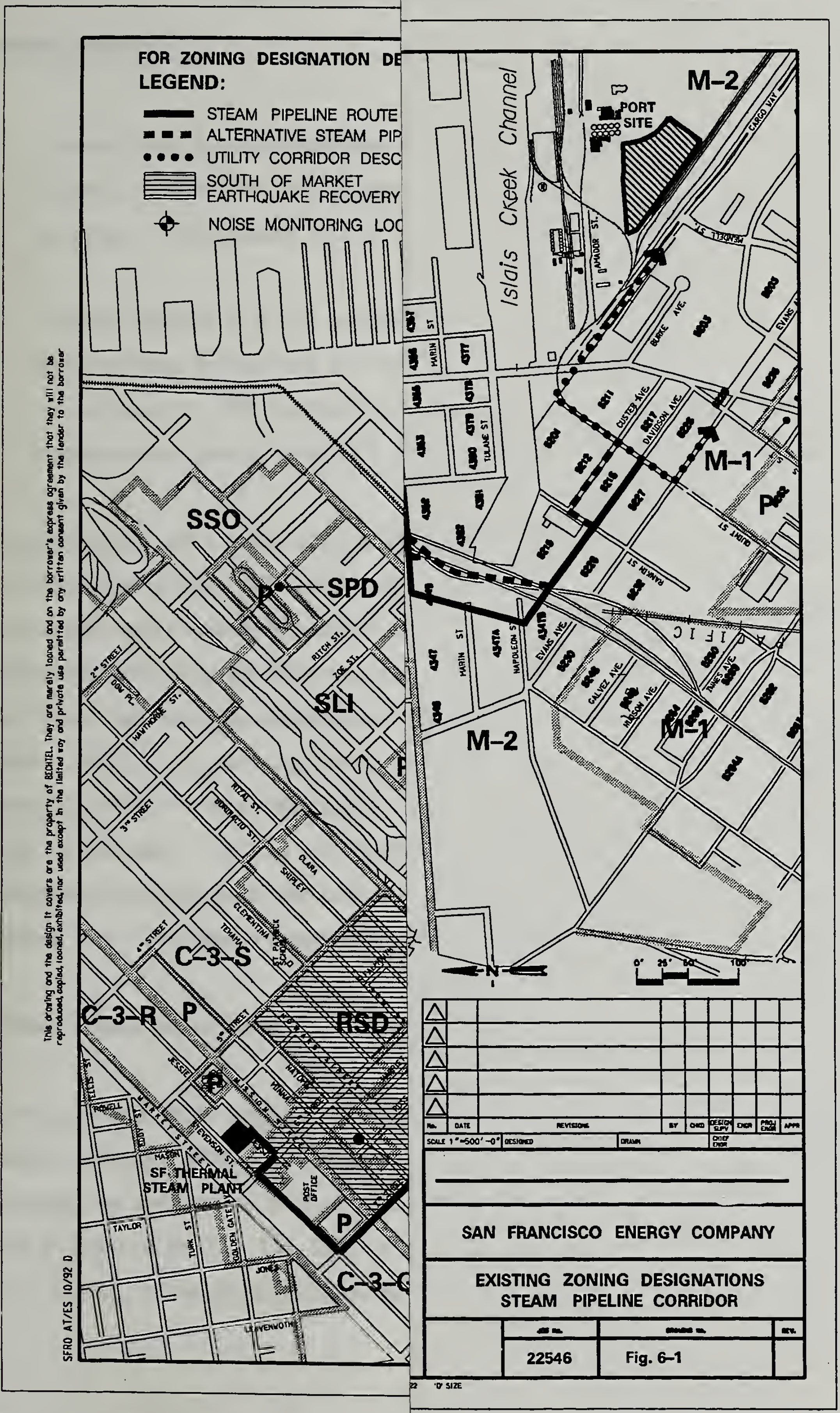
6.1.3 Noise Measurement Methodology

To characterize the existing noise environment of the pipeline corridor, five locations were selected for noise measurement. The five noise measurement locations, labeled NM-11 through NM-15, are shown in Figure 6-1. These locations were chosen to be representative of the various district types found along the steam pipeline corridor.

- Location NM-11 is on the west side of Indiana Street about midway between 25th Street and 23rd Street. It is in front of a house at 1270 Indiana Street, which is a detached single-family residence located in an M-2 district.

- Location NM-12 is on the east side of Indiana Street halfway between 22nd Street and 20th Street. At this location there is a direct line-of-sight to the backside of a row of three-story residential buildings located on the west side of Minnesota Street, which is one block east of Indiana Street. These homes are in an RH-3 district.

- Location NM-13 is at the northeast corner of the intersection of Mississippi Street and Mariposa Street in front of a store with an apartment above. This location is in an M-1 district. There are many residences half a block away in an RH-2 district. Some of these homes have direct line-of-sight to NM-13.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NOISE MONITORING LOC
Islais Creek Channel
PORT SITE
M–2
CARGO WAY
AMADOR ST.
WENDELL ST.
BURKE AVE.
EVANS
MARIN ST
TULANE ST
CUSTER AVE.
DAVIDSON AVE.
M–1
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Fig. 6–1
'D' SIZE
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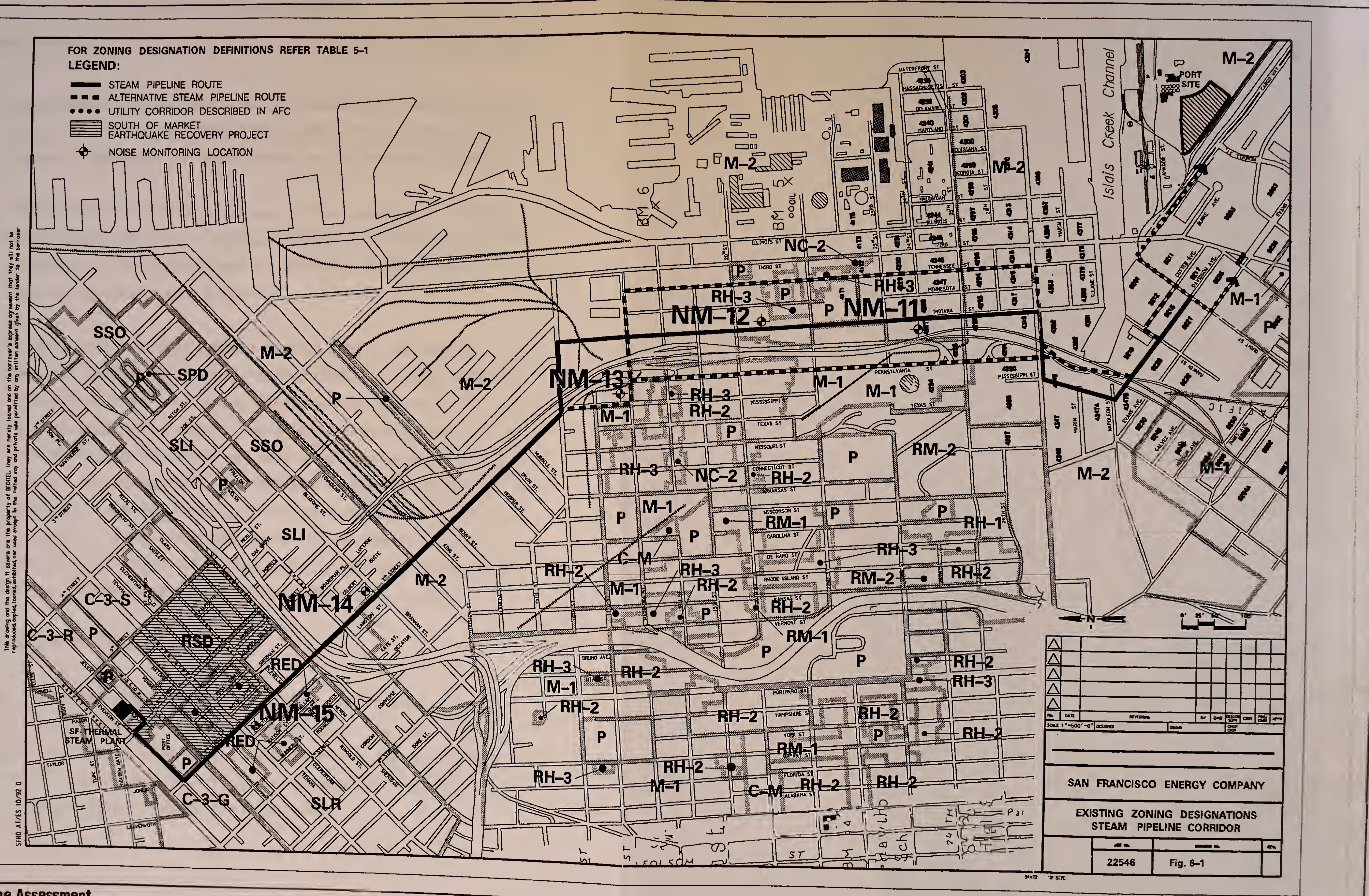
Figure 6-1
Steam Pipeline Route and Noise Monitoring Locations


FOR ZONING DESIGNATION DEFINITIONS REFER TABLE 5-1
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ALTERNATIVE STEAM PIPELINE ROUTE
UTILITY CORRIDOR DESCRIBED IN AFC
SOUTH OF MARKET EARTHQUAKE RECOVERY PROJECT
NOISE MONITORING LOCATION
NM-11
NM-12
NM-13
NM-14
NM-15
SF THERMAL STEAM PLANT
PORT SITE
Islais Creek Channel
SSO
SPD
SLI
M-2
M-1
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C-3-S
C-3-R
C-3-G
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Fig. 6-1
34x22
'D' SIZE
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SFRO AT/ES 10/92 D

Figure 6-1
Steam Pipeline Route and
Noise Monitoring Locations

- Location NM-14 is at the northeast corner of the intersection of 7th Street and Brannan Street in front of the 798 Brannan Street building which contains an upper-floor apartment. This location is in an M-2 district and is adjacent to an SLI district.

- Location NM-15 is at the southwest corner of the intersection of 7th Street and Howard Street in front of a new apartment building. There are also new apartments above stores on the northeast corner of 7th Street and Howard Street. These apartments are located in an SLR district.

Noise measurements were made using a Type 1 Precision Sound Level Analyzer (Hewlett Packard 3569A) and a Type 1 Precision Sound Level Meter (B&K 2215). Both were calibrated prior to and after each measurement session using a 94 dB sound calibrator (B&K 4230). Noise levels were monitored using the slow response mode on the sound level meter or the sound level analyzer. Percentage exceedance calculations were made over a 1-hour duration at each location to determine the L_{10}, L_{50}, and L_{90} levels. The noise level descriptor prescribed in the San Francisco Police Code is equivalent to the L_{50} level, which represents in essence the median noise level in the area. The L_{90} level reflects the more-or-less constant background noise, excluding events of a transient nature such as cars passing by, planes overhead, people shouting, dogs barking, etc. The more transient sounds are better reflected in the L_{10} levels.

6.1.4 Noise Measurement Results

Noise measurements were made between the hours of 11 a.m. and 5 p.m. since pipeline construction activities will occur during daytime hours only. The results of the noise measurements are summarized in Table 6-1, in which the existing daytime noise levels are presented in terms of the L_{10}, L_{50}, L_{90}, and L_{eq} values for each of the five noise monitoring locations. The L_{eq} values were calculated from the L_n values.

Table 6-1 Measured Noise Levels along the Pipeline Route

Noise Descriptor	Noise Measurement Locations/Noise Levels in dBA				
	NM-11	NM-12	NM-13	NM-14	NM-15
L_{10}	66	74	75	76	75
L_{50}	63	72	68	71	71
L_{90}	61	66	63	66	65
L_{eq}	63	70	68	70	70

Interstate Highway 280 runs parallel and in close proximity to the pipeline for most of the length of the pipeline. This highway is currently partially closed to traffic due to earthquake damage, but is scheduled to fully reopen in 1996. The ambient noise levels in the area can be expected to increase by a significant amount when this freeway is once again in full service.

6.1.5 Terminology

The following terms are used in this section:

- Sound Level or Noise level. The A-weighted sound pressure level with reference to 20×10^{-6} Pa, expressed in units of A-weighted decibel (dBA).

- Sound Power Level. The level of the A-weighted sound power with reference to 1 picowatt, expressed in units of dBA.

- Percentage Exceedance Sound Level (L_n). The sound level that is exceeded during n percentage of the measurement duration, expressed in units of dBA.

- Equivalent Sound Level (L_{eq}). The sound level of a constant sound that has the same energy as the time-varying sound over the same time period, expressed in units of dBA.

- Noise Reduction. The amount by which the source noise is reduced through the implementation of a noise reduction measure, expressed in units of decibel (dB).

- Ambient Noise Level. The noise that is prevalent at a location. In the San Francisco Police Code, this level is in essence equated to L_{50}.

6.2 Environmental Consequences

6.2.1 Construction Noise Impacts

6.2.1.1 Truck and Auto Traffic

Pipeline construction traffic will make use of both freeways in the area. At present, Interstate Highway 280 is partially closed to traffic for earthquake repairs and seismic upgrades but is expected to be in full use prior to construction of the pipeline. The traffic volumes for cars and trucks on the area freeways are normally quite high. There will be no measurable increase in the freeway noise due to pipeline construction.

Construction truck traffic off the freeways will be routed through Army Street and 7th Street, which are already used by many trucks. Although a very slight increase in truck and auto traffic along these streets during the construction period can be expected, the noise impact of this increase will be inconsequential.

6.2.1.2 Pipeline Site Activities

The pipeline construction period is expected to last approximately 12 months. Onsite construction activities can be divided into four distinct phases: site preparation, trench digging, pipe laying, and backfilling and finishing. The major construction equipment items likely to be used in each of the four phases are shown in Table 6-2. Based on the results of the geotechnical study and the shallow depth of the line, sheet piling will not be needed. In Table 6-2, the distance of 50 feet is used to calculate the expected noise levels. This distance represents the estimated average distance of pipeline construction equipment to the nearest residences along the pipeline route.

Table 6-2 Noise Emissions from Pipeline Construction

Construction Phase	Equipment	Max. Sound Level @ 50 ft dBA	Quantity	Usage Factor	L_{eq} @ 50 ft dBA	Remarks
Site Preparation	Air Compressor	80	1	0.80	79	
	Paving Breaker	85	1	0.40	81	
	Loader	83	1	0.40	79	
	Dump Truck	87	2	0.30	85	
	Composite Level				86	
Trenching Operation	Back Hoe	84	2	0.80	86	
	Dump Truck	87	3	0.50	89	
	Pump	79	1	1.00	79	
	Pneumatic Tools	84	6	0.30	87	
	Air Compressor	80	1	0.80	79	
	Composite Level				92	
Pipe Laying	Haul Truck	87	1	0.30	82	
	Loader	83	2	0.50	83	
	Mobile Crane	82	1	0.80	81	
	Back Hoe	84	1	0.50	81	
	Composite Level				88	
Backfilling and Finishing	Air Compressor	80	1	0.80	79	
	Back Hoe	84	2	0.80	86	
	Loader	83	1	0.40	79	
	Compactor	84	2	0.80	86	
	Steel Roller	81	1	0.60	79	
	Dump Truck	87	2	0.50	87	
	Composite Level				92	

Based on the data presented in Table 6-2, the projected noise levels in terms of L_{eq} at 50 feet would be around 86 to 92 dBA, which is higher than the existing ambient level in the area. However, the projected impact would last no more than a few weeks for each receptor.

6.2.1.3 Noise Reduction Measures

Reduction of construction noise is achieved through the following measures:

- Restricting the noisier activities, especially trench digging, to daytime hours. Nighttime operations will be limited to low-noise activities only.
- Equipping the impact tools and equipment that exceed the limit of 80 dBA at 100 feet with intake and exhaust mufflers as recommended by the manufacturers.
- Equipping the pavement breakers and jackhammers that exceed the limit of 80 dBA at 100 feet with acoustically attenuating shields or shrouds as recommended by the manufacturers.
- Controlling worker noise exposure by requiring use of appropriate hearing protectors.

6.2.1.4 Resolution of Complaints

During the construction period, all noise complaints received would be directed to the construction manager or a designated representative for response. Details of each complaint, including the name, address, and telephone number of the complainant, and the nature of the complaint, would be entered into a logbook. Actions would be taken in a timely manner to resolve the complaint as needed, and the complainant would be advised accordingly within 3 working days of the complaint.

6.2.2 Operation Noise Impacts

No operation noise impact is expected because the pipeline will be buried underground.

6.3 Laws, Ordinances, Regulations, and Standards

6.3.1 Worker Noise Exposure

Worker noise exposure limits are set by U.S. Occupational Safety and Health Administration (OSHA) regulations. The current regulations limit the allowable noise exposure to 90 dBA for 8 hours or its equivalent, and limit the maximum allowable level to 115 dBA. The California Occupational Safety and Health Administration (CAL-OSHA) regulations are identical to the federal OSHA regulations. There are no city or county regulations regarding worker noise exposure.

6.3.2. Environmental Noise Limits

There are no federal or state regulations that restrict noise emissions from construction and operation of pipelines. Limits on noise from pipeline construction and operation activities are contained in Article 29 of the San Francisco Police Code.

SFPC 2907(b) limits noise emission from operation of construction equipment to no more than 80 dBA when measured at 100 feet, or an equivalent sound level at some other convenient distance. Impact tools and equipment are exempted from complying with the 80 dBA limit "provided that such impact tools and equipment shall have intake and exhaust mufflers recommended by the manufacturers thereof and approved by the Director of Public Works as best accomplishing maximum noise attenuation, and that pavement breakers and jackhammers shall also be equipped with acoustically attenuating shields or shrouds recommended by the

manufacturers thereof and approved by the Director of Public Works as best accomplishing maximum noise attenuation."

SFPC 2908 limits construction work to between 7 am and 8 pm when the noise emission is in excess of the ambient level by 5 dBA at the nearest property line, unless a special permit has been applied for and granted by the Director of Public Works.

SFPC 2909 addresses noise from fixed sources. The limits provided therein are substantially higher than any noise that might come from a buried steam pipeline.

6.3.2.1 Conformance of Facility

This pipeline will be designed, constructed, and operated in accordance with all applicable federal, state, and local LORS.

6.4 Cumulative Impacts

There will be no increase in long-term noise levels due to operation of this pipeline. The cumulative impact of the construction noise related to the pipeline will be negligible because the construction period will be of short duration.

6.5 References

Barnes, J.D., L.N. Miller, and E.W. Wood. 1977. Power Plant Construction Noise Guide, BBN Report No. 3321 Prepared for Empire State Energy Research Corporation.

San Francisco Police Code, Article 29. 1984. Regulation of Noise.

U.S. Environmental Protection Agency. 1975. Noise Emission Standards for Construction Equipment, Report No. 550/9-76-004.

7.0 PUBLIC HEALTH

Public health issues that could be affected by the SF Energy steam pipeline corridor are described in the following section.

7.1 Affected Environment

The pipeline corridor begins at Cargo Way and ends near Stevenson and 6th streets (see Figure 1-2). The corridor passes through primarily industrial and some commercial land use areas. These are described in detail in Section 5.0.

7.1.1 Site Assessment

The steam pipeline will be located beneath paved and rocked areas, primarily within street rights-of-way. The nature of the soils within the corridor is described in Section 12.0.

As a typical practice in the City and County of San Francisco for installation of underground utilities, the soils in the excavation areas will be examined during construction.

During the excavation process, soil contamination will be monitored on an ongoing basis by trained health and safety professionals. Should contamination be discovered, based on the contaminant, the soil and contaminants will be disposed off per applicable regulations.

Once the steam pipeline is in place, backfilled, and road repair is completed, no environmental impact will be realized by the community during normal operation.

7.1.2 Hazardous Materials

During construction, some hazardous materials typical of current construction practices may be used. These include paint, lubricating oils, welding materials, and other construction-related materials. During construction, these will be secured so that they do not come in contact with the public. Once construction is completed, these materials will be removed from the project area and will have no impact on the surrounding area.

7.2 Environmental Consequences

7.2.1 Criteria Air Pollutants

There will be no air pollutants generated by the steam pipeline during normal operation. Potential air pollutants generated during construction are discussed in Section 2.0.

Hazardous Materials Emissions Limitations. There will no emissions of hazardous materials from the steam pipeline during operation. The normal operation of the steam pipeline does not involve the use of hazardous materials and there are no hazardous materials in the steam. Other than impacts discussed in Section 2.0, there are no public health impacts from the construction and operation of the pipeline. Therefore, there will be no cumulative impacts from the construction and operation of the pipeline.

During construction, all hazardous materials described above will be handled in accordance with all applicable federal, state, and local health and safety LORS.

7.3 Laws, Ordinances, Regulations, and Standards

Laws, ordinances, regulations, and standards (LORS) exist at the federal, state, and local levels to protect the public from exposure to toxic levels of hazardous materials. The LORS that apply

to the construction and operation of the pipeline are listed in Section 5.6.3 of the SF Energy AFC.

7.3.1 Conformance of Pipeline

As addressed in this section and in Sections 4 and 5.7 of the SF Energy AFC, the pipeline design, construction, and operation are in accordance with all applicable legal requirements and generally accepted industry standards for the protection of public and worker safety and health.

7.4 References

American Society for Testing and Materials (ASTM). 1993. *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process (E 1527-93).*

California Air Pollution Control Officers Association (CAPCOA). 1992. Air Toxics "Hot Spots" Program Risk Assessment guidelines.

U.S. Environmental Protection Agency. 1987. *Technical Guidance for Hazards Analysis*, Emergency Planning for Extremely Hazardous Substances, EPA, Federal Emergency Management Agency, U.S. Department of Transportation, December.

8.0 WORKER HEALTH AND SAFETY

This section discusses worker health and safety items that are related to the steam pipeline.

8.1 Hazard Identification

Potential worker hazards within the corridor during construction and operation include handling, storage, and use of hazardous materials; high noise levels; temperature extremes; operating heavy and mechanical equipment; energized equipment and tools; steam; confined spaces; atmospheric contaminants; excavation and trenching; electrical hazards; compressed gases and/or liquefied flammable and nonflammable gases; and elevated work. Potential worker hazards are listed in Table 8-1.

Hazardous materials are comprised of standard construction materials such as paints, lubricating oils, welding rods, and petroleum-based fuels.

8.2 Hazard Assessment

Pipeline construction, operation, and maintenance activities expose workers to the hazards identified in Table 8-1. Accidents during these activities may affect worker health and safety. These potential health and safety impacts are avoided through adherence to appropriate engineering design criteria and compliance with all applicable health and safety laws, ordinances, and standards. The programs, regulations, and preventive measures intended to control potential worker health and safety impacts associated with these hazards are described in Section 8.4.

A comprehensive health, safety, and fire prevention program is established and maintained that enforces safe and healthful practices and implements an accident/injury prevention program intended to ensure healthful and safe operations along the steam pipeline corridor.

8.3 Cumulative Impacts

No significant cumulative worker health and safety impacts result from pipeline construction and operation. The pipeline corridor is zoned for commercial industrial development. Although other nearby facilities can pose a health and safety risk to employees working within the corridor, similar health and safety programs implemented by these facilities minimize these potential cumulative impacts.

8.4 Preventive Measures

The preventive measures listed in this section are those typical for utility construction projects. Worker health and safety issues within the corridor are avoided through adherence to all applicable laws, ordinances, regulations, and standards (LORS). These LORS are presented in Section 5.7.5 and Section 7 of the AFC. All elements of the Title 8 CCR, General Industry Safety Orders (GISO), Construction Safety Orders (CSO), and Electrical Safety Orders (ESO), with special attention paid to Section 3203, Injury and Illness Prevention Program, are addressed in this section.

The project manager has the responsibility and authority to ensure a safe and healthful environment at this site. The project manager provides leadership and direction to the site managers and supervisors to ensure that all the health, safety, and fire prevention requirements are met and that all personnel are providing full program support.

The project health and safety professional provides program oversight. The health and safety professional, through the authority of the project manager, has the authority to stop any activity or modify any work practices if the site health and safety program is violated or if such action is necessary to protect the workers, physical plant, or surrounding community. The health and safety professional also directs the designated site safety representative.

Table 8-1 Potential Worker Hazards

Activity	Hazard
Pipeline Construction and Operation/Maintenance	
Elevated work	Falls
Welding	Flash burns, explosion, thermal burns, toxic welding fumes
Excavations	Excavation/trench wall collapse, spoil movement, oxygen deficiency, build-up of toxic gasses, fumes, vapors, dusts or mists, wet exposures, crushing hazards, confined spaces
Cement/forms work	Falls, protruding objects, slips, trips, caustics, punctures, and lacerations
Equipment operation	Noise exposure, vehicle accidents, load hazards; induced current
Painting	Paint solvents, paint vapors, chemical burns, fire/explosion, falls
Abrasive blasting	Dust, flying particles, pressure vessels, noise
Powered hand tools	Noise, dust, flying particles, cuts, amputation, crushing
Fueling	Fire and explosion, environmental contamination
Machinery, general	Noise, temperature extremes, rotating equipment, electrocution

The designated site safety representative assists the health and safety professional in managing and overseeing of the health, safety, and fire prevention program.

Project management and supervision furnishes total program support by both example and by ensuring that those responsible to them are adhering to the program requirements.

8.4.1 Program Elements

The health, safety, and fire prevention program includes the elements shown in Table 8-2. This table also serves as reference to applicable regulations.

8.4.2 Employee Orientation and Training

Each new or reassigned employee receives a thorough health and safety orientation that gives the basic information about the health, safety, and fire prevention program, federal OSHA, CAL-OSHA, and other applicable rules and regulations. When necessary, additional instructions are furnished at a later date for the performance of hazardous or unusual tasks. Employee attendance is mandatory and appropriate records are kept on file at the site for the duration of the facility life and then maintained at least for the time period required by the applicable regulations.

The orientation includes the following topics:

- Health, safety, and fire prevention program requirements;
- Program health and safety manual review;
- Employer/employee responsibilities under CAL-OSHA and OSHA;
- Eye protection;
- Head protection (hard hats);

Table 8-2 Health, Safety, and Fire Prevention Program Elements

Program Element	Regulation
Health and safety program responsibilities	8 CCR, Section 3203, GISO, and Section 1509, CSO.
Public safety	
Traffic safety	8 CCR, Article 25, GISO, and Article 11, CSO.
Fire safety	8 CCR, Group 27 and Section 3221, OISO, and Article 36, CSO.
Environmental health and safety	
Occupational health and safety	CAL-OSHA
Airborne contaminants	8 CCR, Section 5155, GISO, and Article 4, CSO.
Accident/incident prevention	8 CCR, Section 3203, GISO, and Section 1509, CSO.
Regulatory compliance	(CAL-OSHA, OSHA)
Plans for weekly toolbox meetings during construction	8 CCR, Section 3203, GISO, and Section 1509, CSO.
Health and safety literature to be provided employees	8 CCR, Section 3203, GISO, and Section 1509, CSO.
Health and safety education planned for the project	8 CCR, Section 3203, GISO, and Section 1509, CSO.
First aid and emergency medical procedures	8 CCR, Section 3400, GISO, and Section 1512, CSO.
Emergency response plans (fire, earthquake, bomb threat, etc.)	8 CCR, Section 3220, GISO
Hazardous materials management and communication	8 CCR, Section 5194, GISO
Accident and incident reporting	8 CCR, Section 3203, GISO, and Section 1509, CSO.
Personal protective equipment (clothing, hard hats, vests, shoes, goggles, masks, gloves, hearing protection, etc.)	8 CCR, Articles 10, 10.1, 11, and Section 5144, GISO, and Article 24, and Sections 1514, 1515, 1516, 1517, 1518, 1520, 1521, 1522, CSO.
Inspections	8 CCR, Section 3203, GISO, and Section 1509, CSO.
Health and safety responsibilities of supervisory personnel	

Table 8-2 Health, Safety, and Fire Prevention Program Elements (Cont'd)

Program Element	Regulation
Health and safety checklists	
Signs, tags, and barriers	8 CCR, Sections 3216, 3320, 3321, 3638, 4649, 4827, 5470, 5483, GISO.
Noise levels and control	8 CCR, Group 15, Article 105, GISO.
Provisions for ventilation	8 CCR, Group 16, Article 107, GISO.
Flammable/combustible materials handling and storage	8 CCR, Group 20, GISO, and Article 36, CSO.
Machine guarding	8 CCR, Group 8, Articles 54, 55, and 59, GISO, and Sections 1582.16, 1582.18, 1680, CSO.
Hand and power tool use	8 CCR, Article 20, GISO, and Articles 26, 27, and 28, CSO.
Crane and hoist operation	8 CCR, Group 13, GISO, and Articles 9, 14, and 15, CSO.
Heavy equipment and machine operation	8 CCR, Article 25, GISO, and Article 10, CSO.
Pile driving	8 CCR, Article 12, CSO.
Illumination	8 CCR, Section 1523, and Article 24, CSO.
Electrical safety	8 CCR, Subchapter 5, ESO.
Housekeeping	8 CCR, Section 1513, CSO.
Utilities, below and above ground	
Rigging	8 CCR, Article 101, GISO, and Article 15, CSO.
Fall protection and scaffolding	8 CCR, Articles 21, 22, 23, and 24, CSO.
Sanitary facilities	8 CCR, Article 9, GISO, and Sections 1519, 1524, 1526, and 1527, CSO.
Interface with other contractors	
Report formats	
Sample accident reports and other report forms	
Drug and alcohol program	
Employee/employer communications	8 CCR, Sections 3203, 3204, 5193, 5194, and Article 10, GISO, and Section 1509, CSO.

- Hearing conservation; and
- Respiratory protection.
- Fall protection, safety harnesses, and lifelines;
- Scaffolding;
- Security;
- Perimeter guarding;
- Housekeeping;
- Fire protection;
- Injury/illness reporting;
- Hazard communication/right to know;
- Emergency procedures;
- Evacuation;
- Tagging procedure;
- Suitable work clothing and apparel;
- Trenching and excavations;
- Materials handling, rigging, and crane safety;
- Electrical safety;
- Signs, tags, and barriers;
- Sanitation; and
- Environmental health and safety.

8.4.3 Supervisor Orientation and Training

Upon assignment or promotion, the supervisors take part in an orientation program pertaining to health, safety, and fire prevention program responsibilities. Each orientation must cover at a minimum the subjects indicated below. Orientation records are kept on site for the duration of the facility life, then maintained as per regulatory requirements.

- Health, Safety, and Fire Prevention Program. Supervisors review the program and their responsibilities.

- Healthful and Safe Work Areas. Each supervisor is required to be familiar with the conditions in each area of the facility to which employees are assigned. Supervisors correct, when possible, hazardous conditions that exist in the work place before work begins. Otherwise, the supervisor brings these conditions to the attention of the next higher supervision level for resolution.

- Healthful and Safe Work Practices. Each supervisor, when making work assignments, informs employees of the safe work practices, work methods, and personal protection required. Each supervisor is responsible for ensuring that the workers have the proper tools and protective equipment before work starts.

- Supervising for Health and Safety. Supervisors continuously review the safe practices and procedures of their crews and initiate corrective action when necessary.

- Toolbox Meetings. During construction, each supervisor conducts tool box safety meetings at least once a week. Subject material is related to the tasks on hand, and employee input is encouraged. Issues presented by the employees are addressed by the supervisor. If the issue(s) cannot be resolved at that level, the next higher supervisor takes remedial action.

- Facility Operations Health/Safety Meetings. Meetings are conducted on a monthly basis. Additional meetings are held to conduct related orientation and training activities. Attendance at these meetings is mandatory and attendance records are maintained on site. Outside contractor personnel are required to attend a contractor safety orientation class before being allowed to do any onsite work. Visitors to the facility are given a brief orientation prior to being given a guided tour of any portion of the facility.

- Emergency Procedures. Supervisors are made familiar with the facility's emergency procedures and with their roles so that they may provide leadership in an emergency.

- Accident Investigations. Each supervisor participates in the investigation of any accident or incident that results in:
  - Personal injury to a member of that supervisor's crew;
  - Equipment or property damage in that supervisor's area of responsibility; or
  - A near miss that had the potential for serious injury, death, or extensive property damage.
- First Aid. Each supervisor notifies all employees of their obligation to report immediately all injuries/illnesses, however minor, in accordance with the facility procedures.
- Fire Protection. Supervisors maintain a constant awareness of the fire potential in their area of responsibility and ensure that proper fire prevention methods are in place.

8.4.4 Weekly Toolbox Meetings

Weekly toolbox meetings are conducted during construction by the supervisors to keep personnel informed on current health and safety issues per the Injury and Illness Prevention Program (8 CCR, Section 3203, GISO, and Section 1509, CSO). All attendees are encouraged to actively participate in these meetings and establish good labor/management communications. Attendance is mandatory and attendance records are kept at the facility.

8.4.5 Hazard Correction

Procedures and methods for abating hazards are established based on 8 CCR, Article 4 CAL-OSHA guidelines on hazards classifications: immediately dangerous to life or health, serious, and other than serious. Conditions considered as immediately dangerous to life and health require immediate correction, removal of employees from the hazard, or supplying required personal protective equipment until such time as the condition is corrected. Serious and

other than serious hazards are prioritized according to the nature of the hazard, and necessary safeguards such as employee removal, change of operation, cessation of operation, or use of personal protective equipment are used as interim measures until the hazardous conditions are corrected. Hazards not immediately corrected are tracked by the health and safety professional to ensure timely abatement.

8.4.6 Health, Safety, and Fire Prevention Inspections

A formal site health and safety survey is conducted on a periodic basis. During these inspections, unsafe conditions are identified by the team and corrected by the responsible party, or employees may be removed from harm's way. The identified hazards are discussed and methods to prevent recurrence determined.

8.4.7 Job Hazard Analysis

All site construction workers and operations employees' safety and health are ensured via a system plan of task-specific job hazard analyses for construction and maintenance of the pipeline. Before the start of each task or operation, the supervisor determines in coordination with the crew the apparent hazards associated with the performance of their task. The hazard(s) are required to be identified, and appropriate precautions, such as employee education, equipment tagout, personal protective equipment, or change in work routine, are initiated to protect the health and safety of the employees prior to work initiation.

8.4.8 First Aid and Medical Support

First aid support is available to the construction workers and operations employees, and a log is kept of all reported injuries and illnesses (OSHA 200 Log). The medical services are obtained and an emergency hospital or treatment center identified as part of the Injury and Illness Prevention Program (8 CCR, Section 3203, GISO, and Section 1509, CSO). The hospital or

medical center is contacted before work begins to ensure that the hospital or center can respond to emergencies in the event of an accident or injury.

8.4.9 Incident Reporting

Accidents and incidents are investigated by the designated site safety representative and facility supervision and written reports submitted to the facility manager within 24 hours of any occurrence involving disabling injuries, fatalities, or hospitalization or involving property damage or fire loss in excess of $500. Notification must be made in accordance with 8 CCR, Article 3, Section 342.

Less serious accidents and incidents are investigated by the designated site safety representative and the supervisor for the employee(s) involved in the accident or incident. Written reports are maintained at the facility office, and an oral report is made to the facility manager. Results of the accident and incident investigations are communicated to the site personnel through staff and tool box meetings.

8.4.10 Record Keeping

The records required to be maintained such as medical and training records are kept per applicable regulatory requirements.

8.4.11 Occupational Health

All reasonable steps and precautions to protect the employees' health are taken. Occupational health monitoring and sampling are conducted, as required, to determine employee exposure levels to hazardous dusts, fumes, vapors, mists, gases, oxygen deficiencies, or physical agents. The frequency and types of personal and area samples, instrumentation, and techniques are described in the program. Sample results are communicated to the affected employees and records maintained as required.

- Hazard Communication. A hazard communication or right-to-know program (8 CCR, Section 5194, GISO) is established to comply with CAL-OSHA requirements. MSDSs for each hazardous material used on site are maintained and available for employee perusal. A list of chemicals used on site is maintained.

- Hazardous Waste. In conjunction with the hazard communication program, a plan to properly handle and dispose of construction wastes generated within the work area is prepared. Workers at the site may perform emergency response operations, including cleanup of hazardous materials spills and repair of equipment handling hazardous material. The plan complies with 8 CCR, Section 5194, GISO.

- Confined Spaces. A confined spaces entry program, complying with 8 CCR, Section 5156, GISO, including permitting procedures, is established to address the types of entries anticipated in the working environment. Necessary personal protective equipment, safeguards, attendants, signals, etc., are included in the program.

- Respiratory Protection. A respiratory protection program complying with 8 CCR, Section 5144, GISO, requirements is developed, including respirator training, fit testing, monitoring, selection, etc. The work atmosphere is tested/sampled per the established protocol.

- Hearing Conservation Program. An effective hearing conservation program, complying with 8 CCR, Group 15, Article 105, GISO, that includes work exposure evaluations, hearing protection devices, training, audiometric testing, medical evaluations, and engineering controls, where necessary, is established. The construction and permanent physical facility areas are posted where high noise levels exist.

- Sanitation Program. The sanitation program provides, at a minimum, the necessary toilet and washing facilities, change rooms, eating/drinking facilities, water supply,

and related items, complying with the requirements for sanitary facilities (8 CCR, Article 9, GISO, and Sections 1519, 1524, 1526, and 1527, CSO).

8.4.12 Fire Protection and Prevention

Construction fire regulations in 8 CCR, Section 1620 et seq. are followed as necessary to prevent construction fires. Special attention is paid to operations involving open flames, such as welding, and use of flammable materials. Personnel involved in such operations must have appropriate training by the contractor. A fire watch, utilizing appropriately classed extinguishers or other equipment, is maintained during hazardous work operations. Site personnel are not expected to fight fires past the incipient stage. The local responding fire officials are given information on the site hazards and the location of these hazards, and the information is included in the emergency response planning.

Materials brought on site conform to contract requirements insofar as flame resistance or fireproof characteristics are concerned. Specific materials in this category include fuels, paints, solvents, plastic materials, lumber, paper, boxes, and crating materials. Specific attention is paid to compressed gas, fuel, solvent, and paint storage. Storage of hazardous materials on site is discussed in Section 8.0.

8.4.13 Lockout/Tagout

During construction and facility operations, numerous machines and systems are energized electrically, mechanically, hydraulically, or pneumatically. This may present a hazard, especially if energy is released while personnel are working on or servicing the machines or system. To preclude injury due to machine/system energy release, a tagout program is effected.

8.4.14 Crane and Material Handling

Crane operations and material handling comply with the applicable rules, regulations, and associated standards, per 8 CCR reference in Table 8-2. Equipment or machinery intended for material or personnel handling is not brought on site without proof of current inspection. Inspection records are renewed before expiration, since failure to keep them current results in equipment shutdown and removal.

Personnel operating equipment such as personnel lifts, forklifts, and scissor lifts receive documented training and instruction on the proper and safe operation of the equipment. Safe operating procedures, equipment limitations, and manufacturers' recommended operating criteria are stressed. Personnel are not allowed to operate these types of equipment until such training is received.

Rigging personnel are experienced, and safe operational procedures are followed. A rigging inspection program is implemented and inspections documented. Only the recommended hand signals for controlling crane operations referenced in 8 CCR Section 5001 are used on site. Cranes, backhoes, and other equipment that may come in contact with energized power lines maintain at least a 10-foot distance between any vehicle part and the energized line.

8.4.15 Noncompliance with Health, Safety, or Fire Requirements

The facility manager or his or her designee monitors the health and safety performance of employees as well as contractor employees on site. All are required to comply with the established health, safety, and fire prevention program as well as the applicable federal, state, and local regulations, standards, and statutes. Noncompliance with these may result in cessation of work operations until such items (persons) in noncompliance are corrected.

Supervisors advise employees that if they jeopardize their own safety or health or the health or the safety of others they are subject to disciplinary action up to and including discharge. The disciplinary actions are formalized, reduced to writing, and provided to all personnel.

8.4.16 Emergency Response Program

An emergency response program is prepared that addresses potential emergency conditions such as earthquakes, fires, bomb threats, pressure vessel ruptures, aqueous ammonia releases, and other catastrophic events. Warning devices, evacuation routes, assembly areas, and other forms of action taken in the event of an emergency are included. Arrangements with response units are also included. A sample emergency response plan outline is included as Table 8-3.

8.4.17 Health and Safety Committee

A committee consisting of a representative cross section of the operating facility personnel is established and monthly meetings held to promote health and safety on the job. Issues such as employee complaints, incentives, inspections, healthful and safe working conditions, and communications are integral to the committee charter.

8.4.18 General Safety Requirements

8.4.18.1 Signs, Tags, and Barricades

The necessary signs, tags, and barricades comply with 8 CCR references in Table 8-2 and are erected to protect site employees and the public from construction and operational hazards. In addition to signs warning of hazards, such as high voltage, flammable materials, low clearance, and the like, informational signs advising of restricted area, parking, loading zones, etc, are provided. A specific section addressing sign, tag, and barrier requirements is included in the health, safety, and fire prevention plan.

Table 8-3 Sample Emergency Response Plan Outline

1.0 Introduction
  1.1 Purpose
  1.2 Scope

2.0 Responsibilities
  2.1 Construction/Facility Manager
  2.2 Construction/Facility Supervisor
  2.3 Crafts/Operators
  2.4 Health and Safety Manager
  2.5 Security

3.0 Response and Notification Plan
  3.1 Supervisor/Emergency Coordinator
  3.2 Health and Safety Manager

4.0 Response Procedures
  4.1 Evacuation Routes and Procedures
  4.2 Site Security
  4.3 Emergency Medical Treatment and First Aid
  4.4 Decontamination
  4.5 Documentation and Record keeping
  4.6 News Media
  4.7 Emergency Notification List
  4.8 Emergency Telephone Numbers List

5.0 Reference Procedures
  5.1 Security
  5.2 Accident Reporting and Investigation
  5.3 Lockout/Tagout
  5.4 Hazard Communication
  5.5 Spill Containment and Reporting
  5.7 First Aid and Medical Response
  5.8 Respiratory Protection
  5.9 Personal Protective Equipment
  5.10 Sanitation
  5.11 Work Site Inspections

8.4.18.2 Housekeeping

During construction, the contractor is responsible to ensure that the site is kept in a clean, safe, and healthful condition. The facility manager and all operating personnel assume this responsibility during operation. Good housekeeping complies with 8 CCR references in Table 8-2 and helps to prevent slips, trips, falls, and related incidents. Fire hazard potential is also minimized.

8.4.18.3 Fall Protection, Safety Harnesses, and Lifelines

A section of the health and safety program complies with 8 CCR, Articles 21, 22, 23, and 24, CSO, and specifically addresses these issues, and training is provided by the crew supervisor before the start of high work. Harnesses are employed for fall protection; belts, if employed, are primarily for lateral restraint. The facility, in the program, strives for 100 percent fall protection through the use of belts, harnesses, nets, or other effective means.

8.4.18.4 Excavations

Excavations, trenches, and belowground work have the potential for collapse, falling debris, earth movement, employee suffocation, crushing, falls, engulfment, and exposure to dusts, fumes, gases, vapors, mists, and oxygen deficiency as well as to biological and other related hazards. Work in and around these areas requires strict adherence to applicable rules and regulations, such as the 8 CCR Construction Safety Orders, Article 6, Excavations. A competent person is required to be available to provide necessary guidance and direction to workers in excavations. In addition, the competent person is assured immediate access to the appropriate testing equipment, especially if the excavation is more than 4 feet in depth. A permit system for entry is put in place for excavations more than 4 feet in depth.

8.4.18.5 Welding and Cutting

Hot work operations create numerous hazards such as radiant energy, thermal burns, generation of toxic materials, oxygen deficiencies, explosion hazards, and others. Thorough task operation evaluations are necessary and applicable health and safety standards and regulations followed.

8.4.18.6 Security

Security personnel are on site 24 hours a day, 7 days a week, to ensure physical facility security. The security assignment may be a collateral duty to a person(s) on shifts, or the service may be contracted to an outside agency. Specific duties are assigned in writing to include not only security functions but also emergency response duties.

8.4.18.7 Personal Protective Equipment

Personal protective equipment complies with 8 CCR references in Table 8-2 and is worn when conditions warrant it or when specified in a construction or operational procedure. Should questions arise concerning the proper use and selection of equipment, the craft/operator supervisor is consulted. If resolution is not reached, the designated site safety representative may be contacted. The basic protective equipment guide is included as Table 8-4.

Table 8-5 is an outline of the Injury and Illness Prevention Program.

8.5 Laws, Ordinances, Regulations, and Standards

Construction and operation of the steam pipeline will conform to all applicable laws, ordinances, regulations, and standards. These are listed in Section 5.7.5 of the AFC.

Table 8-4 Basic Protective Equipment Guide

Body Area	Hazards	Recommended Protection
Eyes/Face	Low velocity particles	Safety glasses with side shields
	High velocity chips and sparks	Impact goggles or safety glasses with full face shield
	Corrosive liquid transfer	Chemical goggles and face shield
	Welding	Welding hood or goggles with appropriate filter lenses
Head/Ears	Construction, overhead and electrical hazards	Hard hat
	High noise levels	Ear protection
Respiratory System	Nuisance dusts	Half face respirator with dust filter
	Solvent vapors	Half face respirator with organic cartridge
	Acid gases	Full face respirator with acid gas cartridge
	Unknown or high contaminant concentrations	SCBA[1] for IDLH[2] atmospheres, O_2 deficiency
Hands/Arms	Rough or sharp objects	Leather gloves
	Hot objects	Insulated leather gloves
	Solvents, acids, bases	Impervious synthetic gloves
	Electric current	Dielectric gloves
Feet	General wear	Substantial boots with heel
	Handling heavy objects	Boots, safety toed
	Wet work or work with corrosives	Synthetic boots
Body	Hot or corrosive liquids	Chemical resistant apron
	Punctures, impact/cut	Canvas, leather, or metal apron
	breaking chemical lines	Full body protection with chemical resistant clothing
Fall Protection/Rescue	Elevated work, unprotected	Harness and lanyard
	Vessel entry	Harness and lifeline
	Suspended scaffold	Harness/lifeline/lanyard

[1] SCBA = self-contained breathing apparatus
[2] IDLH = immediately dangerous to life or health

Table 8-5 Injury and Illness Prevention Program

1. Person or persons with authority for implementing the IIPP	a. Facility Manager has authority and is responsible
2. System for assuring that employees comply with safe and healthful work practices	a. Training Programs - Employee Orientation and Training, Supervisor Orientation and Training, Weekly Toolbox Meetings (for construction only), Job Hazard Analysis, and Fire Protection and Prevention. b. Disciplinary Actions - Noncompliance with Health, Safety, or Fire Requirements c. Other Means - Health and Safety Committee
3. System for communicating with employees	a. Toolbox Meetings during construction b. Inspections c. Job Hazard Analysis d. Health and Safety Committee e. Job Injury and Illness Board, Employee Notification Board, and Training Programs as indicated in item 2 f. Employee Orientation and Training

Table 8-5 Injury and Illness Prevention Program (Cont'd)

4. Procedures for identifying and evaluating work place hazards	a. Supervisor Orientation and Training - Healthful and Safe Work Areas b. Toolbox Meetings during construction c. Inspections d. Job Hazard Analysis e. Occupational Health f. Health and Safety Committee
5. Procedures for investigating occupational illnesses or injuries	a. Incident Reporting b. Supervisor Orientation and Training
6. Method or methods for correcting unsafe or unhealthy conditions, work practices, or procedures in a timely manner based on hazard severity	a. Hazard Correction b. Inspections c. Job Hazard Analysis
7. Provide training and instruction	a. Employee Orientation and Training b. Supervisor Orientation and Training c. Toolbox Meetings during construction d. Job Hazard Analysis e. Occupational Health

9.0 SOCIOECONOMICS

9.1 Affected Environment

9.1.1 Community Character

For most of the length of the proposed pipeline routing, the community characteristics are the same as those described for neighborhoods within 2 miles of the proposed cogeneration plant. Moving north from the South Bayshore Area, the alignment follows I-280 north on Indiana Street along the eastern slope of Potrero Hill. This area contains a mix of industrial uses, including warehousing and trucking, as well as office commercial uses in remodeled old industrial buildings, such as the Esprit Executive Office. Parallel streets, including Tennessee and Pennsylvania, have blocks with clusters of single-family and small multifamily buildings.

Along 7th Street, the bulk of the elevated freeway and multiple railroad tracks dominate the environment until those uses turn to the east and the alignment transitions into the Showplace Square District where designer's wholesale and retail showrooms have transformed older, multi-story industrial buildings into intensively used structures. The Hall of Justice and County Jail are located at Bryant Street and 7th Street, but these uses are separated from the downtown area by the elevated I-80 approach to the Bay Bridge. For approximately the northernmost half mile, the alignment follows the more traditional industrial frontage of 7th Street, which, as it approaches Market Street, becomes more commercial in character, including several modern motels. Within the northern area, there are scattered apartment buildings and single-room occupancy hotels within one or two blocks of the proposed right of way.

9.1.2 Population and Housing

The demographic and economic characteristics of much of the pipeline corridor are reflected in the description of the environment within 2 miles of the proposed cogeneration plant. In the

northernmost mile of the corridor, the characteristics change somewhat. There are scattered apartment buildings, single-room occupancy hotels, and congregate housing developments in Census Tracts 176.98, 178, and 180, which include the South of Market area south to Townsend Street. Most of the housing in these tracts is in the blocks from 6th Street east, including the older hotels and newer congregate housing developed around Yerba Buena Center.

The population of these three tracts was of mixed ethnicity in 1990, approximately 41 percent white, 17.5 percent black, and 35 percent Asian. In contrast to the neighborhoods within two miles of the cogeneration plant which have home ownership rates above the City median, the three tracts listed above contained virtually no owner-occupied units according to the 1990 Census, contained many single-person households, and as a result, had lower median household incomes, ranging from a low of approximately $9,200 in tract 178 to a high of $20,725 in tract 180.

9.1.3 Employment

For information concerning employment, refer to Section 5.8.1.3 of the AFC.

9.1.4 Fiscal Conditions

For information concerning fiscal conditions, refer to Section 5.8.1.4 of the AFC.

9.1.5 Public Services and Utilities

9.1.5.1 Schools

For information concerning schools, refer to Section 5.8.1.5 of the AFC.

9.1.5.2 Police

The two police stations that would serve the proposed pipeline are the Potrero Station, which is located at 2300 3rd Street, and the Southern Station, at 850 Bryant Street. The Potrero Station has a staff size of 88 uniformed police officers, and the Southern Station 94. Ideal response times for both stations to the site are the same: 5 to 10 minutes for minor problems, such as malicious mischief or petty theft; 2 minutes for serious injuries; and 2 to 4 minutes for serious robberies or crimes.

9.1.5.3 Fire

The San Francisco Fire Department, with a staff of approximately 1,600, provides fire services for the City and County of San Francisco. Many fire department units serve the proposed project corridor. The department responds to fire alarm boxes along the route, and depending on the type and location of the alarm, could deploy as many as eight units for a given incident. The department's target response time for the project corridor is a maximum of 3 to 4 minutes, although response is often quicker than the target time.

The source of water supply for the San Francisco Fire Department is the domestic water system, provided by the Water Department of the City and County of San Francisco. The fire department also has its own secondary water supply, which uses high-pressure lines and hydrants. The fire department has a mutual aid agreement with San Mateo County.

9.1.5.4 Emergency Medical Services

The San Francisco Fire Department provides first response for medical emergencies. The ambulance system is provided by the San Francisco Department of Health. In life and death situations, patients are transported to San Francisco General Hospital, located at 1001 Potrero Avenue. If it is not a life and death situation, patients are taken to their own hospitals.

9.1.5.5 Water

For information concerning water resources, refer to Section 11.0.

9.1.5.6 Sewer

For information concerning sewers, refer to Section 5.8.1.5 of the AFC.

9.1.5.7 Solid Waste

For information concerning solid waste, refer to Section 5.8.1.5 of the AFC.

9.1.5.8 Natural Gas

For information concerning natural gas, refer to Section 5.8.1.5 of the AFC.

9.1.5.9 Electricity

For information concerning electricity, refer to Section 5.8.1.5 of the AFC.

9.2 Environmental Consequences

9.2.1 Employment

9.2.1.1 Construction

The cost of the proposed pipeline would be on the order of $15 million to $21 million, depending on whether the pipeline extends only to the Port Site or all the way to the Innes Avenue Site. Of this total, approximately $5 to $7 million represents the construction labor

payroll, including indirect costs, and an additional $3 to $4 million represents engineering services, construction management, and related indirect costs. Total construction time required to construct the pipeline will be approximately one year. Total person hours required for construction will be approximately 45,000 to 50,000, translating to approximately 20 to 25 person-years. Operating engineers, pipefitters, and laborers will be the primary trades required. Ten to 15 person-years of labor will be required for engineering and construction management services.

As described in the analysis of construction labor force for the proposed cogeneration plant, the Bay Area has a large and dynamic labor force, and the incremental demand for construction and related workers would not require an influx of additional workers into the Bay Area. Thus, the construction of the proposed pipeline would not have an adverse impact on San Francisco or Bay Area housing demand and need for public services.

9.2.1.2 Operational

A minimal labor force would be required to maintain and operate the proposed pipeline. Functions would include operational monitoring and occasional maintenance activities, which would be handled by employees of the existing steam pipeline system in San Francisco.

9.2.2 Population and Housing

The proposed facility is not expected to have either significant temporary or permanent impacts on population or housing.

9.2.3 Fiscal Impacts

Utility distribution lines, such as the proposed pipeline, are not addressed like conventional industrial property that depreciates. The City collects franchise fees based on the amount of

product (in this case, steam) that can flow through the distribution network. Because the proposed project results in an increase in the size of the steam system, annual franchise fees should increase by approximately $200,000 per year. The fiscal impact should be positive for CCSF.

9.2.4 Susceptible Population

Given the lack of impact on housing demand in the region, it is unlikely that the project adversely impacts particular segments of the local population.

9.2.5 Public Services and Utilities

9.2.5.1 Schools

Since new construction workers are not expected to move into the Bay Area in order to work on the pipeline, the proposed project would have no impact on schools in the area.

9.2.5.2 Police

The project would generate some potential for petty theft of materials and equipment, but it is unlikely that there would be on-street robberies or violence resulting from the project. The minor problems would require response and writing up of incident reports by the police department.

The major police-related impacts would be those generated by the project partially blocking intersections and restricting street widths. These impacts are addressed in Section 10.0 concerning traffic and transportation.

Depending on the level of anticipated impacts of projects such as the pipeline, the City requires contractors to hire flag persons, private security officers, and sworn police officers. The police department participates in a conference to work out specific requirements and procedures with the contractor. For a project such as the proposed project, which would involve the downtown area, it is fairly certain that the contractor would be required to hire sworn police officers to assist with traffic control. Those officers would also be able to fill out any police incident reports that would become necessary during the course of the project. With this mitigation measure, there would be no impact on the police department.

9.2.5.3 Fire

Potential fire-related impacts would be the normal construction-related traffic delays, which could interfere with the response by the fire department to an incident. As is routinely done, the City Public Works Department would require the selected contractor to plan and implement the construction so that fire department access would be minimally impacted.

There is also the remote possibility of the long-term impact of the pipeline rupturing, although since the pipeline is underground it is unlikely for there to be significant danger to the public from such a rupture. To mitigate this potential impact, the fire department would like to have the project sponsor meet with their training division in order to familiarize them with the details of the project, including the types of equipment and what might be anticipated in the event of an emergency.

The proposed project would not have any effect on the Fire Department's ability to serve the remainder of the City or lead to the need for increased personnel or equipment.

9.2.5.4 Emergency Medical Services

Potential emergency medical service-related impacts would be the normal construction-related traffic delays, which could interfere with responses by emergency vehicles to incidents. The selected contractor would be required by the City to plan and implement the construction so that emergency vehicle access would not be significantly impacted.

9.2.5.5 Water

For impacts on water resources, refer to Section 11.0.

9.2.5.6 Sewer

The proposed project would have no impact on the city of San Francisco's sewer system.

9.2.5.7 Solid Waste

The relatively small quantities of nonhazardous waste generated during the construction of the pipeline would have little impact on the city of San Francisco's contracted disposal capacity at the Altamont landfill. Also, the relatively small quantities of hazardous wastes that would be generated during the construction phase would have little impact on the capacity of the hazardous waste landfills in the state, and the hazardous waste treatment operations in San Francisco and the rest of the state.

9.2.5.8 Natural Gas

Because the proposed project would replace steam currently being generated by natural gas by San Francisco Thermal, the project would displace 868,000 MM Btu of natural gas per year. This would represent a beneficial impact in terms of energy consumption.

9.2.5.9 Electricity

The project would have no impact on electricity.

9.3 Cumulative Impacts

The operation of the proposed pipeline would not have any cumulative socioeconomic impacts. Cumulative infrastructure improvement projects could inconvenience some residents, but the impacts would be temporary and not significant.

9.4 Laws, Ordinances, Regulations, and Standards

As addressed here and in Section 5.8 of the AFC, the proposed project will be designed, constructed, and operated in accordance with all relevant federal, state, and local LORS concerning socioeconomics.

9.5 References

San Francisco Energy Company, AFC - Socioeconomic, Section 5.8.

Fong, Arnold. 1995. California Board of Equalization, Department of Assessment Standards.

Telephone communication with Michael Fajans, Gabriel-Roche, Inc. January 9, 1995.

Mahoney, Michael. 1995. Officer, San Francisco Police Department. Telephone communication with Janet Roche, Gabriel-Roche, Inc. January 9, 1995.

Scales, Frank. 1995. Assistant Chief, San Francisco Fire Department. Written communication with Janet Roche, Gabriel-Roche, Inc. January 9, 1995.

10.0 TRAFFIC AND TRANSPORTATION

10.1 Overview

This section describes the existing traffic and transportation system characteristics and the impacts of the proposed steam pipeline. The analysis includes a quantitative evaluation of the potential roadway disruptions and traffic-related impacts. For this assessment, limited qualitative information was also used to evaluate the project impacts. Measures that may reduce or eliminate construction impacts are included.

The discussion below describes the potential traffic and transportation impacts from the proposed steam pipeline. The City and County of San Francisco Department of Parking and Traffic provided the mid-block traffic data used here. Field reconnaissance was conducted on December 6, 1994 to secure existing roadway and parking information along the proposed pipeline routes.

10.2 Affected Environment

Figure 1-2 illustrates all proposed alignments for the steam pipeline. The affected environment is defined by an area within one block of the proposed steam pipeline route from the SF Thermal plant at 6th and Jessie streets to Quint Street. The trenching for the steam pipeline needs only to interconnect with the trenching for the water and gas pipelines on Quint Street between Evans Avenue and Cargo Way. At Quint Street, the steam pipeline will be placed in the same trench as the water and gas lines. The impacts of the water and gas line construction were covered in the AFC.

10.2.1 Existing Transportation System

The discussion below focuses on all of the transportation systems within the study area that may be impacted by the construction of the steam pipeline. The discussion includes the street and roadway system, parking, transit, and bicycle and pedestrian facilities.

10.2.1.1 Street and Roadway System

Table 10-1 summarizes the local roadway characteristics within the study area.

Custer Avenue is a two-lane street with perpendicular parking on both sides of the street. Custer Avenue dead-ends into a large industrial building at Rankin Street. The street is in poor condition, with potholes and few curb improvements.

Davidson Avenue is a two-lane street that runs from 3rd Street to the Southern Pacific Railroad tracks to the northwest of Rankin Street. The street is in poor condition, with potholes and few curb improvements.

Army Street is a major four-lane east-west arterial serving the southeast quadrant of San Francisco. Army Street provides access to both I-280 and U.S. 101. Based upon 1985 data, Army Street carries about 14,000 daily trips and 1,800 peak hour trips.

Indiana Street is a two-lane street that runs north-south from Mariposa Street to Army Street. From Army Street to 25th Street, Indiana Street is one-way northbound. Just north of 25th Street is the on-ramp to I-280 northbound. Indiana Street becomes a two-way street just north of the on-ramp. Several commercial uses are located on Indiana Street. The MUNI and SamTrans bus storage facilities are located at Tubbs Street. Parking varies between perpendicular and parallel curbside parking.

Table 10-1 Description of Streets in the Study Area

Street Name	Lanes	Width	Speed Limit	Parking	Comments
Custer Avenue	2	>50 ft varies	25 mph	2 sides	50-ft-wide travel lanes, no developed curb, perpendicular parking both sides, building at end of street
Davidson Avenue	2	>50 ft varies	25 mph	2 sides	Similar to Custer, ends at Caltrans ROW for I-280
Army Street	4	60 ft	30 mph	2 sides	Freeway access
Indiana Street					
- north of 25th Street	2	50 ft	25 mph	2 sides	Two-way, bus storage at Tubbs, I-280 access
- south of 25th Street	2	52 ft	25 mph	2 sides	One-way NB, parallel parking on east, perpendicular on west
Pennsylvania Street	2	60 ft	25 mph	2 sides	Residential north of 22nd, perpendicular parking both sides, freeway off-ramps
Tennessee Street	2	50 ft	25 mph	2 sides	Discontinuous, many truck movements. Parallel parking on west; perpendicular on east.
16th Street					
- west of 7th Street	4	72 ft	30 mph	2 sides	RR Crossing at 6th Street
Mariposa Street	2	42 ft	25 mph	2 sides	I-280 access, parallel parking
Mississippi Street	2	50 ft	25 mph	2 sides	Parallel parking
7th Street					
- north of Brannan St	4	62 ft	25 mph	2 sides	One-way NB
- between Brannan and Townsend	3	62 ft	25 mph	2 sides	1 lane SB, 2 lanes NB
- south of Townsend	2	52 ft	25 mph	2 sides	Two-way
Stevenson Street	1	narrow	25 mph	One side	One-way alley

Pennsylvania Street is a wide, two-lane north-south street to the west of I-280. Between 18th and Mariposa streets and north of 25th Street, I-280 southbound off-ramps meet Pennsylvania Street. South of 25th Street, an on-ramp provides access to I-280 southbound. Pennsylvania Street runs through a residential neighborhood north of 22nd Street.

Tennessee Street is a two-lane discontinuous street between Mariposa and Marin streets with curbside parking. South of 22nd Street, Tennessee Street serves industrial and warehouse uses with heavy truck movements.

16th Street is a four-lane street east of 7th Street. The Southern Pacific Railroad tracks lie just east of the intersection with 7th Street. The gated, at-grade crossing is used for the Caltrain Peninsula service. At 6th Street, railroad tracks cross 16th Street to access the Southern Pacific Railroad Yards.

Mariposa Street is a narrow two-lane street with parallel parking on both sides of the street. It provides access to I-280 to and from the south.

Mississippi Street is two lanes with parallel parking on both sides of the street. The segment between 16th Street and Mariposa Street is primarily an industrial and commercial mix. Mississippi Street is the continuation of 7th Street south of 16th Street.

7th Street runs perpendicular to Market Street southeast from Market Street to 16th Street. North of Brannan Street, 7th Street is a four-lane one-way street northbound towards Market Street. Between Brannan and Townsend streets, 7th Street is two-way with one lane southbound and two lanes northbound. South of Townsend Street, 7th Street is one lane in each direction. Parking is generally permitted on both sides of the street along the entire length.

Stevenson Street is one of the small alleys running parallel to Market Street between Market and Mission streets. Stevenson Street runs one-way towards the northeast.

10.2.1.2 Parking Conditions

As noted in Table 10-1, parking is allowed on all of the streets along the proposed pipeline route. Parking is a mix of on-street parallel and perpendicular parking.

10.2.1.3 Existing Transit

Existing transit routes near the pipeline route were assessed. Several bus lines cross the proposed pipeline route. Only the Golden Gate Transit buses travel northbound along 7th Street between Howard Street and Market Street. None of the MUNI lines run along the proposed pipeline route. Tables 10-2 and 10-3 detail the various bus routes including frequency of service and cross-street conflicts that may affect the pipeline route.

Table 10-2 Existing Golden Gate Transit Service on Key Streets

Corridor	Sections	Golden Gate Transit Line	Peak Headway[1] AM/PM
7th Street	Howard to Market - northbound Intersection with Folsom - southbound	18 College of Marin/SF	30/30
		54 San Marin/SF	25/30
		72/74 Santa Rosa/SF	15/10
		76 Rohnert Park/SF	30/30
		93 Golden Gate Bridge Shuttle	10/45
		67 Downtown SF Ferry Shuttle	30/30
		10 Tiburon/SF	30/30
		20 San Rafael/SF	30/30
		50 Novato-San Marin/SF	30/30
		60/70/80 San Rafael-Novato-Santa Rosa/SF	30/30

Source: Golden Gate Transit, Bus and Ferry Transit Guide.

[1] Peak headway is the separation interval between arriving transit vehicles.

Table 10-3 Existing MUNI Service on Key Streets

Corridor	Sections	MUNI Line	Peak Headway[1] AM/PM
7th Street	Howard to Market	Golden Gate Transit	
	Intersection with Mission	14 Mission	8/8
		26 Valencia	15/15
	Intersection with Howard	12 Folsom	20/20
	Intersection with Folsom	12 Folsom	20/20
	Intersection with Harrison	9X San Bruno Express	12/9
		9AX San Bruno "A" Express	10/8
		9BX San Bruno "B" Express	10/8
		14X Mission Express	8/9
		27 Bryant	12/15
		42 Downtown Loop	9/9
	Intersection with Bryant	9X San Bruno Express	12/9
		9AX San Bruno "A" Express	10/8
		9BX San Bruno "B" Express	10/8
		14X Mission Express	8/9
		27 Bryant	12/15
		42 Downtown Loop	9/9
Indiana Street	Intersection with 18th St	22 Fillmore	6/7
	Intersection with 22nd St	48 Quintara-24th St	12/12

Source: Muni railway route map and schedules.

[1] Peak headway is the separation interval between arriving transit vehicles.

The Golden Gate Transit Bus Lines 18, 54, 72, 74, 76, 78, and 93 operate during the commute period in the commute direction only, southbound in the morning and northbound in the evening. Line 67 provides shuttle service to and from the Ferry Building during the morning and evening commute periods. Lines 10, 20, 50, 60, 70, 80, and 90 operate daily.

10.2.1.4 Pedestrian/Bicycle Facilities

None of the streets along the proposed pipeline route have defined bicycle routes or lanes. However, the alignment crosses signed bicycle routes at Army Street, Folsom Street, and Howard Street.

10.2.1.5 Conflicts With Other Projects

Caltrans is planning a number of projects along the I-280 corridor which may affect the pipeline construction. The Islais Creek Interchange will not be constructed as part of the I-280 retrofit project. Only roadway and structural upgrades are anticipated for the majority of the I-280 renovation. At the northern terminus of I-280, the portion of the existing freeway structure north of 7th Street will be torn down and replaced with a new set of ramps connecting I-280 with surface ramps at 5th Street and a widened King Boulevard. While most of the projects are scheduled for 1994 and 1995, some of the projects will not be completed until 1997. Caltrans is still working on the construction details and contracts for some of the projects. Therefore, some of the following information may be subject to change in the near future.

The status of the I-280 retrofit work by Caltrans is summarized below.

- South of Army Street to the I-280/U.S.101 Interchange. Retrofit work is 90 percent complete as of December 1994.

- North of Army Street to Brannan Street. Retrofit work is slated to start soon after January 1, 1995 and expected to last 2 years.

- Mariposa Street Interchange. Retrofit of existing columns as part of above 2-year project.

In addition to the I-280 retrofit work by Caltrans, the City of San Francisco has a Clean Water Project underway in the area south of Army Street near the Islais Creek Channel. The project has

several phases. The work on the south side of Army Street is scheduled to be completed in January 1996.

10.2.2 Existing Traffic Conditions

The base condition for evaluating the effects of the proposed pipeline trenching on the existing roadways in the study area is discussed below. Several terms used in the assessment of roadway capacity and traffic flow conditions are defined as follows:

- Average Daily Traffic (ADT). The total number of vehicles passing a given point over an average 24-hour period.
- Volume-to-Capacity (V/C) Ratio. The ratio of the hourly traffic volume to the estimated hourly roadway or intersection capacity. Generally, the v/c ratio is expressed as a number between zero and 1.00.
- Level of Service (LOS). A qualitative means of expressing operating roadways and intersection conditions.

10.2.2.1 Level of Service Criteria

The City of San Francisco Environmental Guidelines require that the Transportation Research Board, Circular 212 Planning Method be used for the level of service analysis.

For roadway segments, the LOS designation and vehicles per hour per lane are detailed similar to that used for the AFC analysis. An average green time/capacity (g/c) ratio of 50 percent was applied for LOS "E". For LOS "D", 42 percent was used while 33 percent was applied for LOS "C". This process produced the following mid-block roadway capacities: LOS "C" = 400 vph; LOS "D" = 500 vph and LOS "E" = 600 vph.

To determine the peak hour LOS on a specific roadway segment, the peak hour roadway volume is divided by the number of available traffic lanes. The resultant volume is compared to the LOS criteria to determine the resultant LOS. For example, if a peak hour directional traffic volume of

1,460 vph is accommodated within three traffic lanes, the resultant LOS for the segment is "C - D" (1,460/3 = 487).

10.2.2.2 Traffic Volumes

This preliminary assessment used currently available daily traffic volumes from the City and County of San Francisco Department of Parking and Traffic (DPT). The count data are summarized in Table 10-4. These data are used in the project impact analysis to determine the potential changes in roadway segment level of service during construction of the pipeline.

Table 10-4 Existing Traffic Volumes

Corridor	Location	Direction	ADT	Date
7th Street	South of Jessie Street	Northbound	16,847	1994
16th Street	West of Third Street	Both	8,091	1986

Source: San Francisco Department of Parking and Traffic

10.3 Environmental Consequences

In this section, the roadway disruptions produced by the trenching operations for the proposed pipeline are addressed.

10.3.1 Project Impact Criteria

The project calls for construction within the traveled way. This construction is associated with the placement of steam pipeline between the SF Thermal plant on Jessie Street between 5th and 6th Streets and either the Port Site or the Innes Avenue Site of the SF Energy facility. The impacts are assessed from the SF Thermal plant to the interconnection with the gas and water lines at Quint Street. To address the potential problems created by the roadway disruptions, a 14-foot construction width is assumed. This would allow for a maximum trench width of 3 feet plus adequate areas adjacent to the trench for equipment and truck movements. The roadway

segment level of service calculations assume that during construction one travel lane plus any adjacent parking will be eliminated.

10.3.2 Impacts of the Project

The project will generate increased traffic due to construction worker vehicles, transport of materials and equipment, and the off-hauling of spoils from the construction site. It should be noted, however, that the amount of traffic generated by these activities is not significant relative to the background traffic conditions. The trenching activities associated with the pipeline construction are expected to proceed at 70 to 100 feet per day, and tie-ins will require 1 week of disruption. No more than 500 feet of roadway and one major intersection will be under construction at any one time. The major components of the construction impacts will be direct disturbances of traffic flows, street operations and curb parking resulting from traffic re-routing; lane blockages produced by project construction; trucks hauling spoils, equipment and materials; and the construction workers themselves commuting to and from the job site.

The impact assessment details the levels of service which occur during construction. The recommended impact reduction measures maximize the amount of available roadway capacity to produce the best level of service possible for the roadway segment. Pedestrian traffic as well as public transit routes will be disrupted temporarily due to trenching. Measures are proposed to minimize disruption of these activities.

10.3.2.1 Roadway Impacts

Trenching for the steam pipeline is required along some local streets. The proposed pipeline routes are indicated on Figure 1-2. Table 10-5 summarizes potential roadway disruptions.

Table 10-5 Roadway Impacts Due to Pipeline Construction in Travel Lane

Roadway Segment	Location	Existing Without Project	Existing With Project (One travel lane only)
7th Street	South of Jessie Street	(1,685/4) = 421 vehicles per hour at LOS C-D	(1,685/3) = 561 vehicles per hour at LOS D-E
16th Street	West of Third Street	(809/4) = 202 vehicles per hour at LOS A	(809/3) = 269 vehicles per hour at LOS A

Table 10-5 shows impacts at locations where traffic volume data were available. Where existing traffic volume data were not available, impacts on two-lane roadways will generally result in a LOS F due to the taking of one travel lane temporarily for the pipeline construction. At locations where the roadway is wide enough to accommodate the construction and two travel lanes, the impacts will be minimal. These impacts are discussed in more detail below.

The following discussion of the construction impacts for the proposed steam pipeline is divided into segments. Alternative routes are discussed where appropriate.

Quint Street to Army Street

From Quint Street around the Islais Creek Channel to Army Street, the proposed route is to run the pipeline down Davidson Avenue from Quint Street to the Caltrans right-of-way and the Southern Pacific Railroad/Caltrain tracks. Along Davidson Avenue, the roadway width of 50 feet is enough to accommodate the pipeline construction and enable traffic to pass.

If an easement can be obtained from the Southern Pacific, the pipeline could follow the right-of-way from the end of Davidson Avenue to Army Street rather than cross to the other side of the tracks. Otherwise, from the end of Davidson Avenue until it meets up with Army Street, the pipeline is no longer on public roadways. The route would cross I-280 and the railroad tracks

to Marin Street. The proposed route crosses Marin Street, which serves as access for several uses including the San Francisco Newspaper Agency and a building supply store. After coming around the Islais Creek Channel, the pipeline route parallels the south side of Army Street.

An alternate plan could be to route the pipeline down Custer Avenue. From the intersection of Custer Avenue and Quint Street, the proposed route follows Custer Avenue to its end at Rankin Street. From the intersection of Custer Avenue and Rankin Street, the route continues through an existing structure, which is a large industrial building that covers the two blocks from Davidson Avenue to the Islais Creek Channel. This building presents an obstacle along this alternative route. The pipeline would need to tunnel under the structure or move around it. To the north is the Islais Creek Channel and to the south is Davidson Avenue. There is not enough room between the building and the channel to lay the pipeline. The Davidson Avenue alignment is more direct and does not have the problems associated with the building at the end of Custer Avenue.

Army Street

The proposed pipeline route parallels Army Street to the south. The south side of Army Street is primarily used for industrial uses. The railroad has tracks along this segment of Army Street. The railroad right-of-way may be used for this part of the pipeline alignment. The City's Clean Water Project is currently under way on the south side of Army Street and is scheduled for completion in January 1996.

Army Street to Mariposa Street

The proposed alignment crosses Army Street at Indiana Street. Traffic on Army Street will be reduced to one lane in each direction during the construction. The proposed steam pipeline route will run along Indiana Street from Army Street north to Mariposa Street. On Indiana Street, either one of the travel lanes or one side of parking will be taken to lay the pipeline. In the one-

way section between Army Street and 25th Street, the worst case is a reduction to one travel lane. For the two-way section, if the trenching is on the west side of the street, which is currently used for perpendicular parking, traffic can pass in both directions, but parking will be lost. Access will be maintained to the maximum extent possible. Should traffic be restricted to one lane, SF Energy will provide traffic control (flag person managing traffic) to maintain the existing traffic pattern to the maximum extent possible.

Two alternatives to the Indiana Street alignment were examined. One alternative is to run the pipeline along Pennsylvania Street from Army Street to Mariposa Street. Pennsylvania Street is parallel to Indiana Street on the west side of the freeway. Pennsylvania Street is wide enough to accommodate the trench and two travel lanes as well as parallel parking on both sides of the street. Parallel parking will result in a loss of parking for the residential area to the north of 22nd Street, which currently has perpendicular parking. The construction may disrupt access to I-280. The Pennsylvania Street alignment avoids crossing the railroad tracks twice by staying on the west of both the SP tracks and I-280; however, construction will be disruptive to the residential neighborhood north of 22nd Street and to freeway access.

The other alternative was to use Tennessee Street which runs parallel to Indiana Street one block to the east. Since Tennessee Street is discontinuous, the through-traffic volumes are low. However, in the industrial/warehouse area to the north of Army Street, Tennessee Street tends to be used as a truck loading area. The Tennessee Street alignment avoids the freeway access ramp off Indiana Street at 25th Street and the bus storage facility at Tubbs Street. However, the trenching may prove to be disruptive to the truck movements along the industrial/warehouse area north of Army Street and to the residential/commercial uses to the north of 22nd Street.

Mariposa Street to 7th Street

At Mariposa Street, the proposed pipeline route continues north from Indiana Street through private property to 16th Street. This section of 16th Street is four lanes with parking, which

provides sufficient width for the trench and for at least one lane of traffic in each direction. Just east of the intersection with 7th Street, the pipeline will need to cross the Southern Pacific Railroad tracks.

An alternative alignment would run the pipeline west along Mariposa Street to Mississippi Street and north to 7th Street. Mariposa Street is a narrow two-lane roadway on structure that carries significant levels of traffic since it provides access to I-280 between Indiana and Mississippi streets. At this location on Mariposa Street, I-280 is above and the railroad tracks are below and the roadway width is narrow. This alignment will involve more than the standard cut-and-cover operation. At Mississippi Street, the pipeline route continues north to 16th Street. Mississippi Street is wide enough to allow traffic in both directions by taking a parking lane for the trenching.

The alternative along Mississippi Street and Mariposa Street may require expensive structural work to cross over the railroad tracks. There appears to be limited vertical clearances to hang a pipeline from the bridge over the tracks. The pipeline may need to parallel Mariposa Street on a separate structure rather than be constructed in the street.

7th Street from 16th Street to Stevenson Street

The proposed pipeline route continues north on 7th Street from 16th Street to Stevenson Street. Between 16th Street and Brannan Street, 7th Street is wide enough to accommodate the trenching operations and two-way traffic, if one curb lane of parking is restricted. North of Brannan Street, 7th Street becomes four lanes in the northbound direction. The trenching operation would entail taking one of these lanes.

Stevenson Street between 7th Street and 5th Street

Parking on Stevenson Street will need to be eliminated during the pipeline construction. Traffic accessing the adjacent properties may be disrupted during the construction. Access will be maintained to the maximum extent feasible.

10.3.2.2 Transit Impacts

Disruptions to transit service would be caused by the pipeline trenching. Tables 10-2 and 10-3 indicate the existing transit services along the local streets. All transit lines will be subject to potential service disruptions created by the pipeline construction activities. Roadway disruptions for trenching may require management of existing transit services. Along 7th Street, the Golden Gate buses will be limited to three lanes of travel. At the cross streets along 7th and Indiana Streets, the pipeline construction will restrict traffic flow to half of the intersection.

10.4 Impact Reduction Measures

10.4.1 Traffic Regulations

The City of San Francisco has established standard specifications for traffic routing in construction areas. Work performed on city streets is required to have construction plans that contain measures to maintain traffic flow to the extent possible. Among the issues which the measures should address are:

- Emergency access
- Street closures
- Temporary travel lane closures
- Maintaining access to adjacent residential and commercial property
- Construction periods
- Removal of on-street parking

10.4.2 Proposed Impact Reduction Measures

10.4.2.1 General

- A Transportation Management Plan will be prepared to detail specific roadway construction information; haul routes; specific data on alignments within each street, as determined during the design phase; prohibition of truck traffic during AM and PM peak traffic periods; signing for disruptions; and public notification identifying location, scheduling and duration of construction spread.

  This management plan will also include necessary Traffic Control Plans for specific roadways and adjacent neighborhoods which may be affected by construction. The Management Plan will address the specific requirements for traffic control, such as construction timing for specific areas and traffic detours.

  The management plan will recommend routes for the transport of equipment and construction materials. The plan will include specific data on pipeline easement alignment within each street, as determined during the design phase, construction zones, and staging areas.

- Whenever feasible on roadways where trenching occurs within the roadway right-of-way, one travel lane should be left open in each direction, delineated by temporary traffic cones/barricades. For minor collectors and neighborhood streets, one lane should be left open with signal persons to direct through traffic.

- Construction work on major roadways and through major signalized intersections should be conducted in off-peak periods (the hours outside of weekday peak commute hours of 7:00 a.m. to 9:00 p.m. and 3:30 p.m. to 6:00 p.m.). Construction within an intersection could be restricted to only half of intersection at any one time in order to maintain traffic flows.

- Construction trenches should be protected with portable Jersey Barriers and cyclone or wooden fencing.

- Private driveways located within construction areas will be kept open to maintain access to the maximum extent feasible. If private driveways are blocked for more than 5 days, metal plates will be used to provide 24-hour access, except for up to 3-hour periods of blockage as needed during construction.

10.4.2.2 Emergency Access

- All City fire, police, and paramedic departments should be notified regarding the schedule and duration of construction activities. Alternative routes should be identified that may be used to avoid construction areas. Access for emergency vehicles should be provided to all properties adjacent to the construction site at all times.

10.4.2.3 Transit Service Disruptions

- To the extent possible, existing Muni and Golden Gate Transit bus routing and bus stop locations will be maintained during construction. If routes must be diverted, adequate notices and signing will be installed to direct patrons to the temporary routing.

- If Muni service requires a detour as a result of limited trolley coach maneuverability, motor coach service could be temporarily substituted, as approved by Muni. Bus stop locations could be temporarily relocated. Motor coach service could be temporarily substituted if the required number of spare motor coaches are available.

10.5 Laws, Ordinances, Regulations, and Standards

The various laws, ordinances, regulations, and standards that affect this project are detailed in Section 5.10 of the AFC.

10.5.1 Conformance

The steam pipeline will be designed, constructed, and operated in accordance with all relevant federal, state, and local LORS concerning transportation and traffic control.

10.6 References

Dowling Associates, 1994. SF Energy Company Application for Certification - Traffic and Transportation Section (5.10).

Mr. John Calderon, Department of Parking and Traffic, City and County of San Francisco. Background daily traffic data for study area.

Mr. Collin Jones, Caltrans Public Information Officer for San Francisco. Information on the status of the I-280 retrofit work.

Mr. Alex Pitcher, Clean Water Project Public Relations. Information regarding the Clean Water Project.

Mr. Maureen McArt, Clean Water Project. Information of the status of the construction on the south side of Army Street.

Highway Research Board, 1985. Highway Capacity Manual. Special Report No. 209.

Transportation Research Board, 1980. Circulation 212.

11.0 WATER RESOURCES

11.1 Affected Environment

The steam pipeline will replace the use of potable water to produce steam with the use of reclaimed wastewater. SF Thermal currently uses potable water to produce steam. The steam pipeline will convey steam from the SF Energy plant, which generates steam by reclaiming wastewater from the Southeast WPCP. The wastewater characteristics, the reclamation treatment process, and the disposal of reclamation process wastewater are as described in the SF Energy AFC. The wastewater reclamation treatment facilities will be located at the SF Energy plant and the wastewater emanating from the reclamation process will be returned to the Southeast WPCP for disposal. The layout of the reclamation plant is the same as shown in the AFC.

Steam usage and consumption at SF Thermal will be the same regardless of the water source.

11.2 Environmental Consequences

Steam production at the SF Energy plant will reduce the amount of potable water consumed by the SF Thermal. For an average steam delivery of 85,000 lb/hr, approximately 10,200 gallons per hour of demineralized water will be produced at the SF Energy plant from secondary effluent. There is a corresponding reduction in demand of 10,200 gallons per hour of demineralized water at SF Thermal. The daily reduction in demineralized water would be approximately 245,000 gallons per day or approximately 80 million gallons per year. The use of reclaimed secondary effluent to provide steam to SF Thermal represents an environmental benefit by reducing potable water consumption.

11.3 System Design

A complete description of the SF Energy wastewater reclamation facility is provided in Section 3.5 of the AFC.

11.4 Laws, Ordinances, Regulations, and Standards

The design, construction, and operation of the steam pipeline relative to water resources will conform to all applicable LORS. The applicable LORS relating to water resources are contained in the AFC.

11.5 References

References are the same as listed in Section 5.13.6 of the AFC.

12.0 ENGINEERING GEOLOGY AND GEOLOGIC RESOURCES

This section describes the site geology of the San Francisco thermal steam pipeline corridor (shown in Figure 12-1), and includes environmental consequences and hazard avoidance measures. Most of the other subsections are as described in the Application for Certification (AFC) for the SF Energy sites, dated July 1994.

12.1 Affected Environment

12.1.1 Regional Geology

The regional geology is the same as described in AFC Section 5.14.1.

12.1.2 Regional Seismology

The regional seismology is the same as described in AFC Section 5.14.1.

12.1.3 Site Geology

12.1.3.1 General

The San Francisco Thermal steam pipeline will be placed in a trench excavated beneath existing city streets. The location of the steam pipeline corridor is shown on Figure 12-1. The corridor runs a distance of about 4 miles from the vicinity of the Port Site to the connecting point at Station T on Jessie Street. The proposed line will be founded in the existing road subgrade materials, or in underlying artificial fill, or on naturally occurring foundation materials. Figure 12-1 shows the geologic formations along the corridor. The steam pipeline route will be through areas similar in geology to those described in Section 5.14 of the AFC. Therefore, Section 5.14 will be used as the basic general description of the geologic aspects of the steam

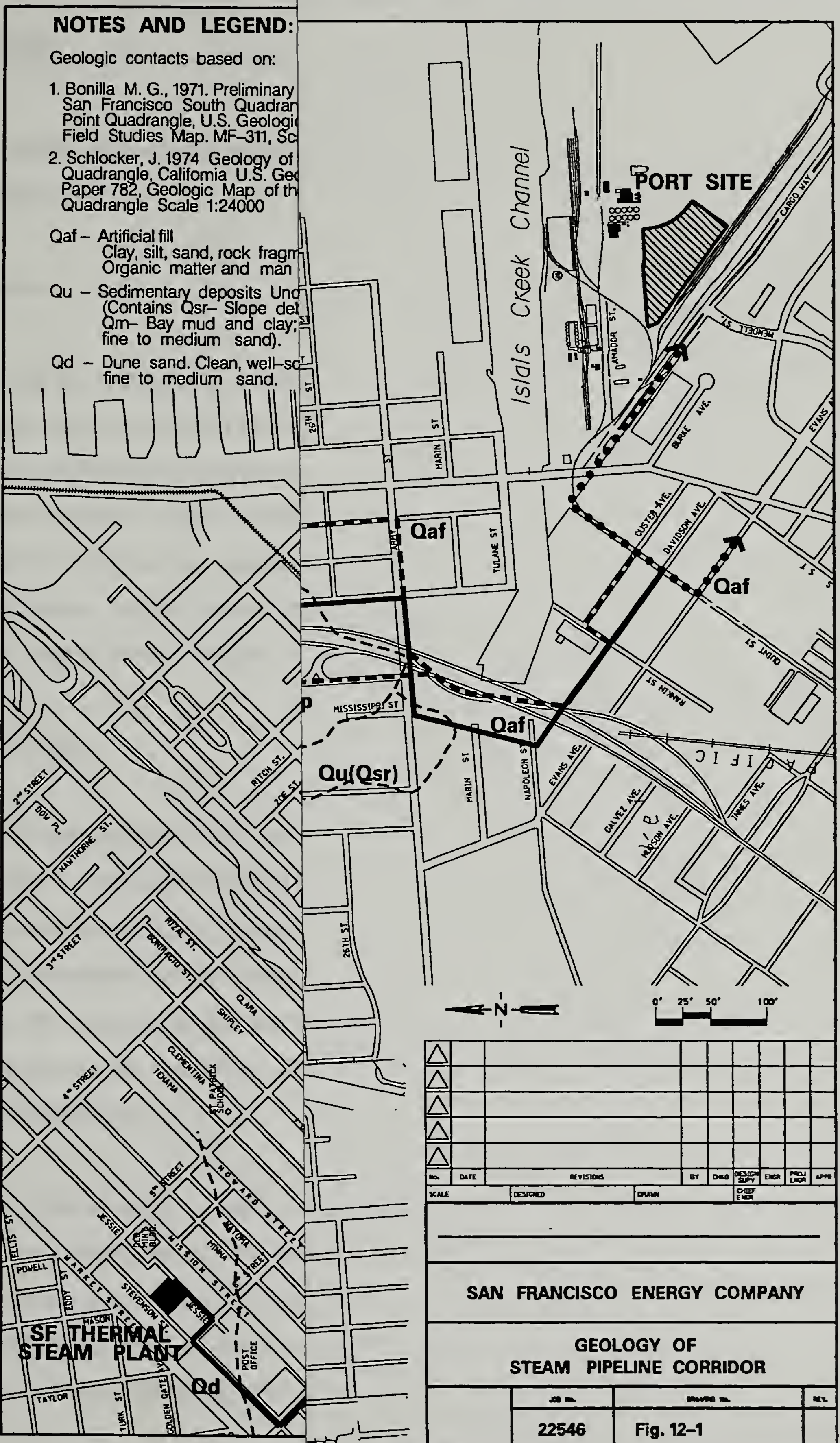
NOTES AND LEGEND:
Geologic contacts based on:
1. Bonilla M. G., 1971. Preliminary
San Francisco South Quadran
Point Quadrangle, U.S. Geologi
Field Studies Map. MF-311, Sc
2. Schlocker, J. 1974 Geology of
Quadrangle, California U.S. Ge
Paper 782, Geologic Map of th
Quadrangle Scale 1:24000
Qaf – Artificial fill
Clay, silt, sand, rock fragm
Organic matter and man
Qu – Sedimentary deposits Unc
(Contains Qsr– Slope de
Qm– Bay mud and clay;
fine to medium sand).
Qd – Dune sand. Clean, well-so
fine to medium sand.
PORT SITE
Islais Creek Channel
CARGO WAY
AMADOR ST.
WENDELL ST
BURKE AVE.
EVANS AVE.
CUSTER AVE.
DAVIDSON AVE.
QUINT ST
RANKIN ST
GALVEZ AVE.
HUDSON AVE.
INNES AVE.
NAPOLEON ST
MARIN ST
TULANE ST
26TH ST
MISSISSIPPI ST
Qaf
Qaf
Qaf
Qu(Qsr)
P
PACIFIC
2ND STREET
DOW PL.
HAWTHORNE ST.
3RD STREET
4TH STREET
5TH STREET
RITCH ST.
ZOE ST.
RIZAL ST.
BONIFACIO ST.
CLARA
SHIPLEY
CLEMENTINA
TEHAMA
ST. PATRICK SCHOOL
HOWARD STREET
NATOMA
MINNA
MISSION STREET
JESSIE
STEVENSON ST
MARKET STREET
ELLIS ST
POWELL
EDDY ST
MASON
TAYLOR
TURK ST
GOLDEN GATE
POST OFFICE
SF THERMAL STEAM PLANT
Qd
N
0' 25' 50' 100'
No. DATE REVISIONS BY CHKD DESIGN SUPV ENGR PROJ ENGR APPR
SCALE DESIGNED DRAWN CHIEF ENGR
SAN FRANCISCO ENERGY COMPANY
GEOLOGY OF STEAM PIPELINE CORRIDOR
JOB No. DRAWING No. REV.
22546
Fig. 12–1
34x22 "D" SIZE

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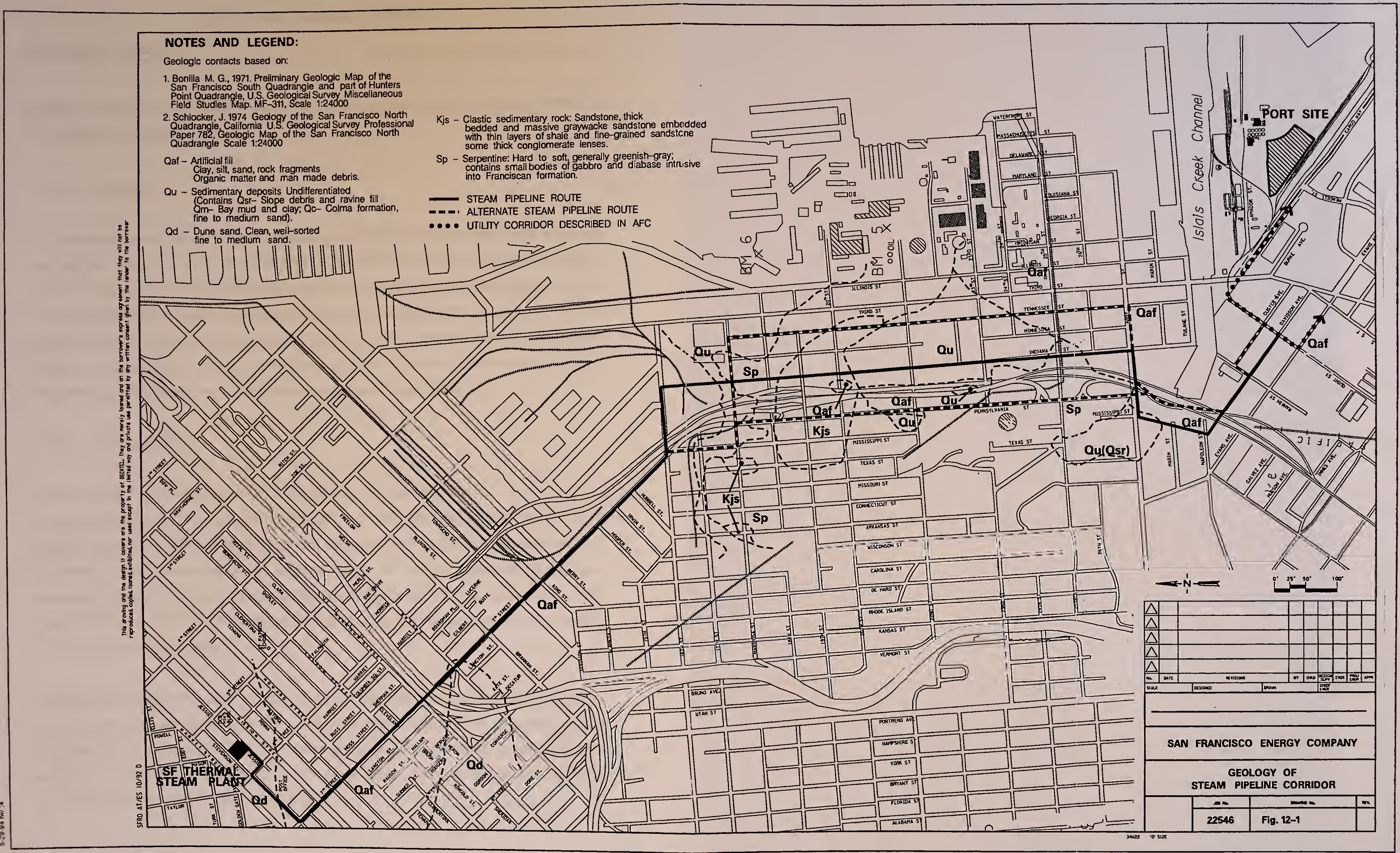
Figure 12-1
Geology of Steam Pipeline Corridor



NOTES AND LEGEND:

Geologic contacts based on:

1. Bonilla M. G., 1971. Preliminary Geologic Map of the San Francisco South Quadrangle and part of Hunters Point Quadrangle, U.S. Geological Survey Miscellaneous Field Studies Map. MF-311, Scale 1:24000
2. Schlocker, J. 1974 Geology of the San Francisco North Quadrangle, California U.S. Geological Survey Professional Paper 782, Geologic Map of the San Francisco North Quadrangle Scale 1:24000

Qaf – Artificial fill
Clay, silt, sand, rock fragments
Organic matter and man made debris.

Qu – Sedimentary deposits Undifferentiated
(Contains Qsr– Slope debris and ravine fill
Qm– Bay mud and clay; Qc– Colma formation, fine to medium sand).

Qd – Dune sand. Clean, well-sorted fine to medium sand.

Kjs – Clastic sedimentary rock: Sandstone, thick bedded and massive graywacke sandstone embedded with thin layers of shale and fine-grained sandstone some thick conglomerate lenses.

Sp – Serpentine: Hard to soft, generally greenish-gray; contains small bodies of gabbro and diabase intrusive into Franciscan formation.

STEAM PIPELINE ROUTE
ALTERNATE STEAM PIPELINE ROUTE
UTILITY CORRIDOR DESCRIBED IN AFC

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SAN FRANCISCO ENERGY COMPANY

GEOLOGY OF
STEAM PIPELINE CORRIDOR

22546 Fig. 12–1

SFRD AT/ES 10/92 D

PORT SITE
SF THERMAL STEAM PLANT
Islais Creek Channel
Qaf
Qu
Sp
Kjs
Qd
Qu(Qsr)
N
0' 25' 50' 100'
No. DATE REVISIONS BY CHKD DESIGN SUPV ENGR PROJ ENGR APPR
SCALE DESIGNED DRAWN CHIEF ENGR
JOB No. DRAWING No. REV.
34x22 'D' SIZE
WATERFRONT ST
MASSACHUSETTS ST
DELAWARE ST
MARYLAND ST
LOUISIANA ST
GEORGIA ST
MICHIGAN ST
ILLINOIS ST
THIRD ST
TENNESSEE ST
MINNESOTA ST
INDIANA ST
PENNSYLVANIA ST
MISSISSIPPI ST
TEXAS ST
MISSOURI ST
CONNECTICUT ST
ARKANSAS ST
WISCONSON ST
CAROLINA ST
DE HARO ST
RHODE ISLAND ST
KANSAS ST
VERMONT ST
BRUNO AVE.
UTAH ST
PORTRERO AVE
HAMPSHIRE ST
YORK ST
BRYANT ST
FLORIDA ST
ALABAMA ST
MARIN ST
TULANE ST
NAPOLEON ST
EVANS AVE.
GALVEZ AVE.
HUDSON AVE.
CUSTER AVE.
DAVIDSON AVE.
BURKE AVE.
AMADOR ST.
CARGO WAY
25TH ST
KING ST.
BERRY ST.
TOWNSEND ST.
BRANNAN ST.
BLUXOME ST.
7TH STREET
HOOPER ST.
IRWIN ST.
HUBBELL ST.
2nd STREET
3rd STREET
4TH STREET
5TH STREET
HAWTHORNE ST.
HOWARD STREET
MISSION STREET
MARKET STREET
JESSIE ST.
STEVENSON ST.
POWELL ST.
EDDY ST.
MASON ST.
TAYLOR ST.
TURK ST.
GOLDEN GATE AVE.
POST OFFICE
BM 6
BM 5X
OIL

Steam Pipeline Assessment

Figure 12-1
Geology of Steam Pipeline Corridor

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pipeline corridor, and the following discussion will only describe specific conditions within the steam pipeline corridor.

12.1.3.2 Topography

The topography along the entire route is relatively flat except for a few short areas where the route crosses bedrock outcrops of the Franciscan Group (Figure 12-1). The greatest variation in grade occurs on the alternative pipeline route along Mississippi Street and Mariposa Street, and on Pennsylvania Avenue. Other variations within the corridor are minimal. The steam pipeline will be placed at an average design depth of 5 feet in trenches under existing public streets. The depth below ground surface may be up to 10 feet in areas where the natural topography requires deeper cuts to maintain an engineered invert gradient.

12.1.3.3 Geologic Units

Based on the geologic map (Figure 12-1), the proposed thermal line route will encounter, at the ground surface, about 85 percent artificial fill (Qaf), 6 percent undivided surficial deposits (Qu), 3 percent Franciscan sandstone (KJs), 4 percent dune sand (Qd), and 2 percent serpentine (sp). The geologic units encountered by the proposed trench will be briefly described below, from youngest to oldest. The deeper geologic units underlying the thermal line trench, such as the Colma Formation (Qc) and the Franciscan Group (KJx) are the same as described in Section 5.14.1.3 in the AFC document.

Artificial Fill (Qaf). These poorly to well-compacted materials are composed of heterogeneous clay, silt, sand, gravel, organic matter, and man-made debris. The artificial fill represents land reclaimed from San Francisco Bay and is predominantly reworked dune sand. It has a maximum thickness of about 50 feet at the Port Site (The Mark Group, 1988) and approximately 20 feet near 7th and Howard streets (Schlocker, 1974b).

Dune Sand (Qd). These unconsolidated, wind-blown sediments at the northern end of the route are typically clean, poorly graded, fine- to medium-grained sand that is yellowish brown to light gray in color. The maximum thickness along the route is about 60 feet (Schlocker, 1974b).

Undivided Surficial Deposits (Qu). This unconsolidated geologic unit, near the southern end of the route, is undifferentiated and includes slope debris and ravine fill, Bay mud and clay, and weathered Colma Formation sediments. The thickness of this unit is unknown.

The slope debris and ravine fill is composed of angular rock fragments in a matrix of sand, silt, and clay. This material is derived from the Franciscan bedrock forming the steep slopes of Potrero Hill.

The Bay mud and clay portion of Qu consists of silty clay with sand, peat, and shell fragments.

Surficial, weathered sediments derived from the Colma Formation are composed of fine- to medium-grained sand with some silt and clay.

Serpentine (sp). Intrusive into the Franciscan Group, this rock is typically soft and sheared and contains some hard knobs of unsheared serpentine. This bedrock forms most of Potrero Hill and crops out near the southern end of the proposed route.

Franciscan Sandstone (Kjs). This member of the Franciscan Group is thick-bedded and massive graywacke sandstone interbedded with thin layers of shale and fine-grained sandstone, with some thick conglomerate lenses. It forms a portion of the bedrock of Potrero Hill.

12.1.3.4 Geologic Structure

The proposed alignment crosses a fault separating Franciscan sandstone from serpentine at the northeast part of Potrero Hill; the fault is buried by Pleistocene surficial deposits (Qu) at the

steam pipeline trench crossing. This fault has not been identified as active (Hart). The remainder of the geologic structures in the study area are the same as described in Section 5.14.1.3 of the AFC document.

12.1.3.5 Groundwater

The static groundwater elevation beneath the steam pipeline route near the Port Site is at about sea level, as determined by borings drilled in 1988 (The Mark Group, 1988). The groundwater level in the artificial fill is probably hydraulically connected to San Francisco Bay. Static groundwater levels along the pipeline route is anticipated to be about at sea level in the areas of artificial fill along the entire route. In the area around the base of Potrero Hill, the route will be slightly elevated and will be in bedrock or undifferentiated sediments. Since the pipeline will be installed at shallow depths beneath city streets, it is not anticipated that groundwater will be a problem. Any localized seepage occurring during construction of the trench will be collected and pumped from the excavation. Areas of seasonal high groundwater levels along the proposed alignment include the Port Site area, Islais Creek Channel, and the China Basin Channel.

12.2 Environmental Consequences

12.2.1 Geologic Hazards

Geologic hazards along the steam pipeline corridor are the same as described in Section 5.14.2.1 of the AFC document. The only geological hazards considered for discussion in this subsection are seismic events causing ground shaking, liquefaction and, consequently, subsidence and differential settlement. These potential hazards will be addressed during the engineering design in accordance with the appropriate pipeline design standards, General Order 112-D.

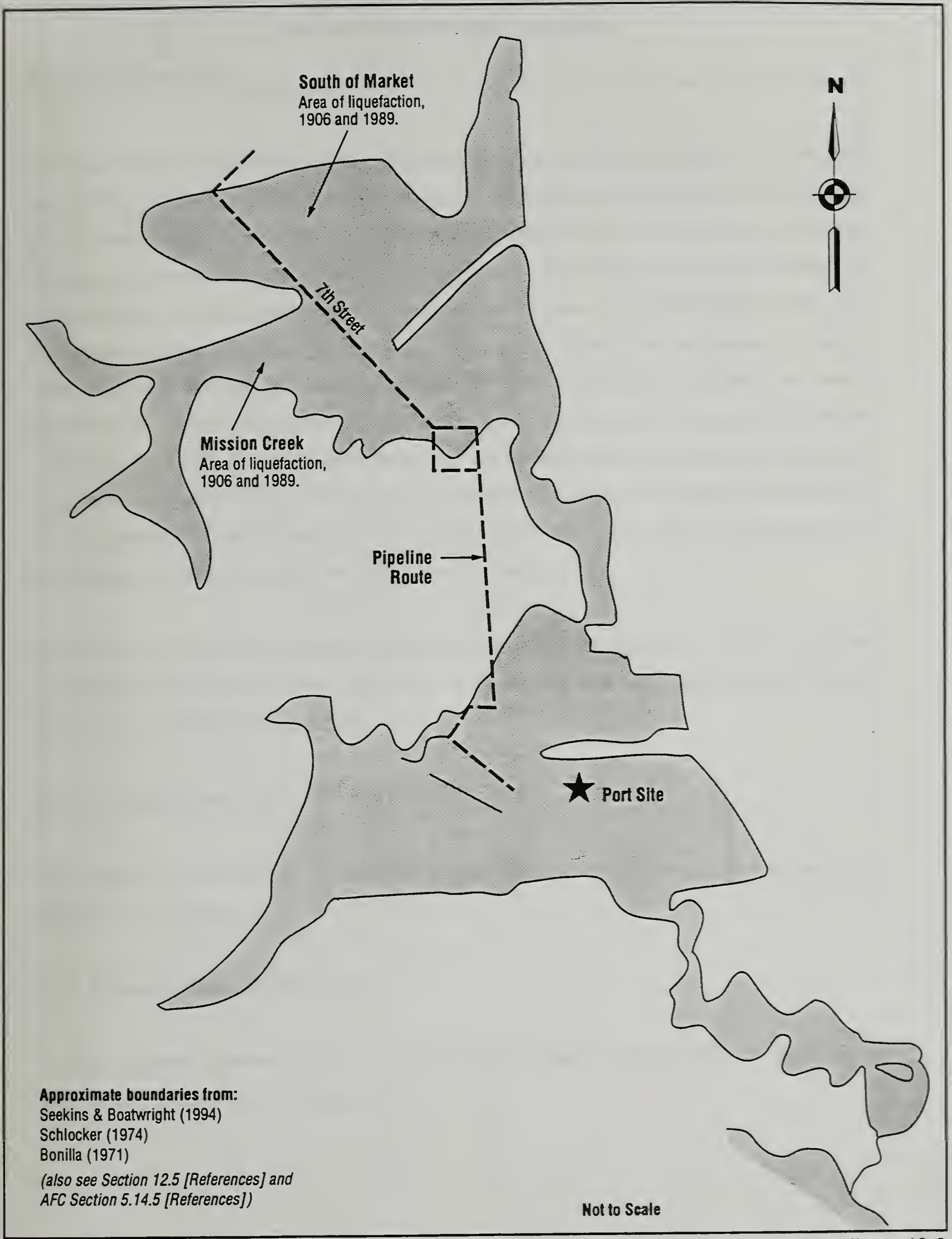
12.2.1.1 Ground Shaking

A generalized sketch map showing the extent of artificial fill and Young Bay Mud along the proposed steam pipeline route is shown in Figure 12-2. Seekins and Boatwright (1994) in their study of ground motion amplification, concluded that "spectral amplification and earthquake damage in San Francisco in both 1906 and 1989 were strongly correlated with the underlying lithologic unit" which will recur in future large earthquakes in the Bay Area. Site-specific response spectra amplification factors for the artificial fill and Young Bay Mud unit, relative to a Franciscan rock site, are given in the study. These factors range from about 5 to 6 times for periods near 1 Hz decreasing to about 1, at periods greater than 10 Hz.

12.2.1.2 Liquefaction and Settlement

During both the 1906 and 1989 Loma Prieta earthquakes, liquefaction occurred in both the South of Market and the Mission Creek areas marked on Figure 12-2 (O'Rourke et al., 1990). The South of Market area includes 7th Street, the proposed alignment of the pipeline between Mission and 16th streets, where, during the Loma Prieta earthquake, liquefaction occurred in the area of artificial fill from approximately Bryant to Mission streets. Sand boils, resulting from liquefaction, were observed along curb and building lines at various locations including an area near 7th and Folsom streets (Seed et al., 1990, O'Rourke et al., 1990).

As described by O'Rourke et al. (1990), significant pipeline damage occurred as a result of both the 1906 and 1989 earthquakes, much of it in the same general areas. In 1989, the highest concentration of pipeline damage was in the area bounded by 8th, Mission, 5th, and


South of Market
Area of liquefaction, 1906 and 1989.
N
7th Street
Mission Creek
Area of liquefaction, 1906 and 1989.
Pipeline Route
Port Site
Not to Scale

Approximate boundaries from:
Seekins & Boatwright (1994)
Schlocker (1974)
Bonilla (1971)
(also see Section 12.5 [References] and AFC Section 5.14.5 [References])

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Figure 12-2
Areas of Bay Mud and Artificial Fill Along the Steam Pipeline Corridor

Harrison with the most serious damage being the break of a 300-mm-diameter cast iron main on 7th Street, between Mission and Howard streets. Differential settlements of between 0.3 and 0.5 m were noted and fractured pavements (indicating lateral movement) were observed throughout this area including a 10- to 30-mm-wide crack down the centerline of 7th Street. In 1906 damage was much greater with displacements of between 5 and 8 feet being noted. It is anticipated that the patterns of liquefaction, differential settlement and consequential damage observed during the 1906 and 1989 earthquakes will occur in the South of Market area during any future earthquakes of equal or greater magnitude. In accordance with usual design practice within the city of San Francisco, the pipeline will not be designed to withstand these anticipated large differential settlements. This is based on the assumption that the pipeline is not essential for the operation of the SF Energy facility or the SF Thermal steam plant. It is assumed that the pipeline will not be in operation after a major seismic event.

In the event of future earthquakes, differential settlement of the compacted backfill foundation supporting the steam pipeline may also occur in the vicinity of Potrero Hill, between bedrock and adjacent unconsolidated materials.

12.2.2 Geologic Resources

The geologic resources along the proposed thermal steam line route are the same as described Section 5.14.2 of the AFC.

12.3 Hazard Avoidance Measures

Hazard avoidance measures along the proposed thermal steam pipeline route are the same as described in Section 5.14.3 of the AFC.

The construction of the pipeline trench will be done in accordance with OSHA regulations. Support of the trench walls and protection of workers required to enter the trench will be provided as required.

12.4 Laws, Ordinances, Regulations, and Standards

The LORS are as described in the AFC in Section 5.14.4. Design and construction of the pipeline will be accomplished in accordance with all applicable legal requirements and generally accepted industry standards.

12.5 References

References are as listed in Section 5.14.5 of the AFC except for the following:

Seed, R.B., S.E. Dickenson, M.F. Riemer, J.D. Bray, N. Sitar, J.K. Mitchell, I.M. Idriss, R.E. Kayen, A. Kropp, L.F. Harder, Jr., and M.S. Power (1990). *Preliminary Report on the Principal Geotechnical Aspects of the October 17, 1989 Loma Prieta Earthquake,* University of California (PB 192 970, April 1990) A08.

Seekins, L.C. and J. Boatwright (1994). "Ground motion amplification, geology, and damage from the 1989 Loma Prieta earthquake in San Francisco," Bulletin of the Seismological Society of America, 84:1, 16-30.

O'Rourke, T.D., H.E. Stewart, F.T. Blackburn, and T.S. Dickerman (1990). *Geotechnical and Lifeline Aspects of the October 17, 1989 Loma Prieta Earthquake in San Francisco*, Technical Report NCEER-90-0001, National Center for Earthquake Engineering Research, State University of New York at Buffalo.

Appendix A
Qualifying Facility Calculations

For purposes of obtaining certification by the California Energy Commission (CEC) and qualifying status from the Federal Energy Regulatory Commission (FERC), SF Energy's Qualifying Facility (QF) conformance is based on steam delivered to SF Thermal.

The process steam sold to SF Thermal allows SF Energy to conform with both the PURPA efficiency standard of 45%, and the PURPA operating standard of 5%.

Efficiency Standard

Efficiency standard is defined as (UPO + 0.5*UTO) / TEI $\geq$45%, where

UPO = useful power output per year = net electric kW * 3,412.1 Btu/kWh * 8,760 hr/yr * load factor.

UTO = useful thermal power output per year = lb of steam/hr * (energy content per lb of steam (Btu/lb) minus energy content per lb of condensate (Btu/lb)) * 8,760 hr/yr * load factor.

TEI = total energy input per year = total fuel consumption per hour (MMBtu/hr) * 8,760 hr/yr * load factor.

For SF Energy:

UPO = 240,000 * 3,412.1 * 8,760 * .96 = 6.9 x 10^6 MMBtu per year.

UTO = 85,000 lb/hr steam flow * (1,211.7 Btu/lb of steam - 0 Btu/lb of condensate) * 8,760 * .96 = 0.9 x 10^6 MMBtu per year. Steam condition is 205 psia, saturated.

TEI = 15.7 x 10^6 MMBtu per year (maximum fuel consumption per page 10 of the recent air quality specification update).

Efficiency standard for SF Energy facility = (6.9 + .5 * .9) / 15.7 = 47%.

T e efficiency of the SF Energy facility is greater than the PURPA efficiency standard of 45%, h nce the SF Energy facility complies with the PURPA efficiency standard.

C erating Standard

C erating standard is defined as UTO / (UPO + UTO) $\geq$5%, where

UTO = useful thermal output per year, as described above.
UPO = useful power output per year, as described above.

UTO = .9 x 10^6 MMBtu per year.
UPO = 6.9 x 10^6 MMBtu per year.

C erating standard for the SF Energy facility = .9/ (6.9 +. 9) = 11%.

T e operating efficiency for the SF Energy facility is greater than the PURPA operating standard c 5%, hence the SF Energy facility complies with the PURPA operating standard.

T e SF Energy facility conforms with both the operating and efficiency standards required for a proval from FERC as a QF under PURPA.

UTO = 85,000 lb/hr steam flow * (1,211.7 Btu/lb of steam - 0 Btu/lb of condensate) * 8,760 * .96 = 0.9 x 10^6 MMBtu per year. Steam condition is 205 psia, saturated.

TEI = 15.7 x 10^6 MMBtu per year (maximum fuel consumption per page 10 of the recent air quality specification update).

Efficiency standard for SF Energy facility = (6.9 + .5 * .9) / 15.7 = 47%.

The efficiency of the SF Energy facility is greater than the PURPA efficiency standard of 45%, hence the SF Energy facility complies with the PURPA efficiency standard.

Operating Standard

Operating standard is defined as UTO / (UPO + UTO) $\geq$5%, where

UTO = useful thermal output per year, as described above.
UPO = useful power output per year, as described above.

UTO = .9 x 10^6 MMBtu per year.
UPO = 6.9 x 10^6 MMBtu per year.

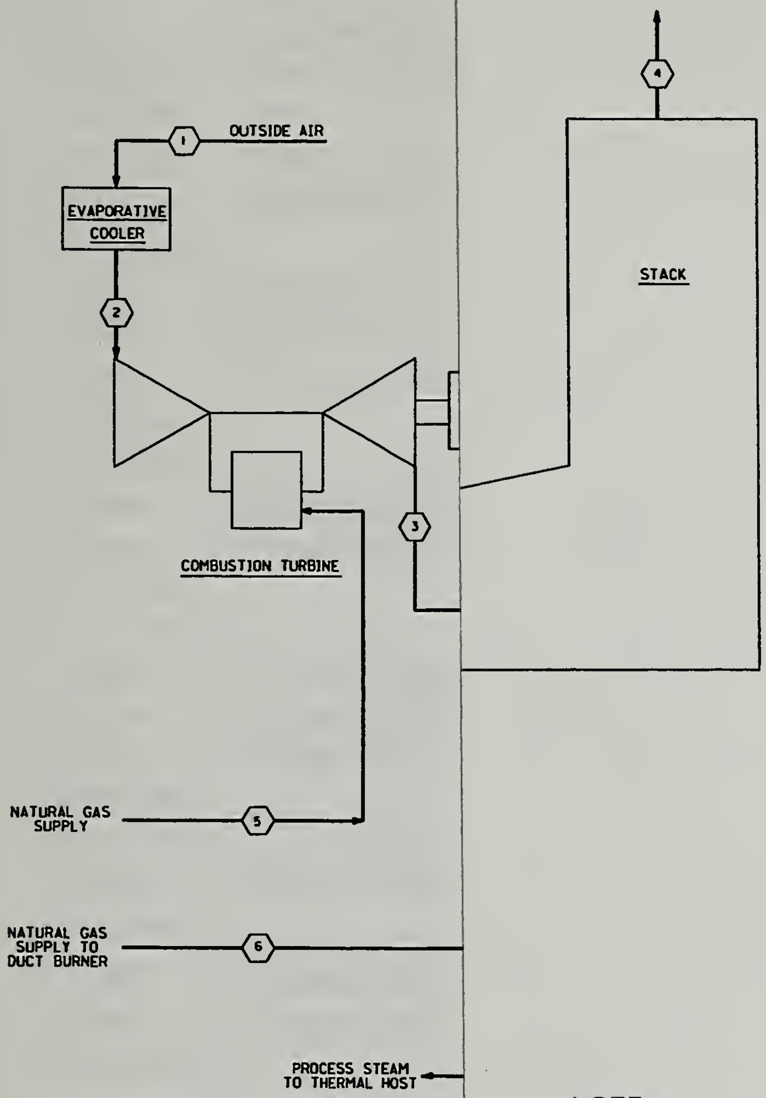
Operating standard for the SF Energy facility = .9/ (6.9 +. 9) = 11%.

The operating efficiency for the SF Energy facility is greater than the PURPA operating standard of 5%, hence the SF Energy facility complies with the PURPA operating standard.

The SF Energy facility conforms with both the operating and efficiency standards required for approval from FERC as a QF under PURPA.

SF Energy will submit an application to FERC for status as a QF prior to March 1, 1995. FERC has 90 days to act on the application, and is expected to certify SF Energy as a QF prior to June 1995.

HEAT BALANCE DIAGRAM AND HEAT BALANCE TABLE


OUTSIDE AIR
1
EVAPORATIVE COOLER
2
COMBUSTION TURBINE
3
STACK
4
NATURAL GAS SUPPLY
5
NATURAL GAS SUPPLY TO DUCT BURNER
6
PROCESS STEAM TO THERMAL HOST

NOTE:

1. SEE SHEET 2 FOR FLOW, TEMPERATURE AND PRESSURE FOR EACH FLOW STREAM.

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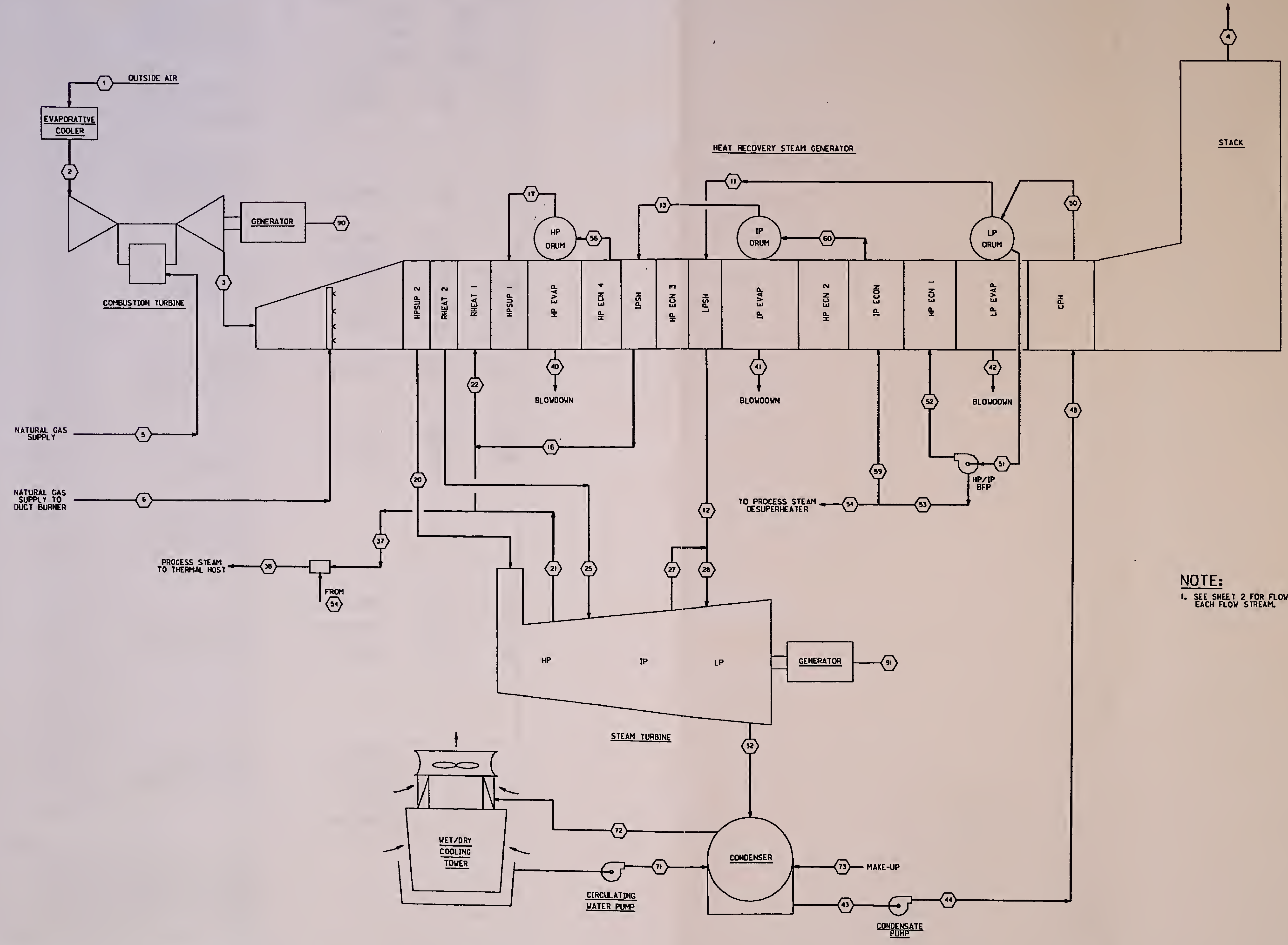
1
OUTSIDE AIR
EVAPORATIVE COOLER
2
GENERATOR
90
3
COMBUSTION TURBINE
NATURAL GAS SUPPLY
5
NATURAL GAS SUPPLY TO DUCT BURNER
6
HEAT RECOVERY STEAM GENERATOR
STACK
4
17
HP ORUM
56
13
11
IP ORUM
60
LP ORUM
50
HPSUP 2
RHEAT 2
RHEAT 1
HPSUP 1
HP EVAP
HP ECN 4
IPSH
HP ECN 3
LPSH
IP EVAP
HP ECN 2
IP ECON
HP ECN 1
LP EVAP
CPH
40
BLOWDOWN
41
BLOWOOWN
42
BLOWOOWN
22
16
52
51
HP/IP BFP
59
48
20
12
TO PROCESS STEAM OESUPERHEATER
54
53
37
PROCESS STEAM TO THERMAL HOST
38
FROM
54
21
25
27
28
HP
IP
LP
GENERATOR
91
STEAM TURBINE
32
WET/DRY COOLING TOWER
72
CONDENSER
71
CIRCULATING WATER PUMP
73
MAKE-UP
43
44
CONDENSATE PUMP

NOTE:
1. SEE SHEET 2 FOR FLOW, TEMPERATURE AND PRESSURE FOR EACH FLOW STREAM.

Stream No.	Commodity	
1	Air	Outside Air
2	Air	Air at Outlet of Ev
3	Air/Gas	Outlet of Gas Tur
4	Exh. Gas	Stack
5	Nat. Gas	Natural Gas Supp
6	Nat. Gas	Natural Gas Supp
10	Not Used	
11	Steam	LP Superheater I
12	Steam	LP Superheater O
13	Steam	IP Evaporator Out
14	Not Used	
15	Not Used	
16	Steam	IP Superheater O
17	Steam	HP Superheater 1
18	Not Used	
19	Not Used	
20	Steam	HP Steam Turbine
21	Steam	HP Steam Turbine
22	Steam	Reheater Inlet
23	Not Used	
24	Not Used	
25	Steam	IP Steam Turbine
26	Not Used	
27	Steam	IP Steam Turbine
28	Steam	LP Steam Turbine
29	Not Used	
30	Not Used	
31	Not Used	
32	Steam	LP Steam Turbine
33	Not Used	
34	Not Used	
35	Not Used	
36	Not Used	
37	Steam	Process Steam Inl
38	Steam	Process Steam to
39	Not Used	
Notes:		
1	Values shown above are base	
2	Heat input to CTG is 1,452 MMB	
3	Heat input to duct burner is 72.8	
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	Flow lb/hr	Temp. F	Pressure psia
	0	N/A	N/A
	0	N/A	N/A
	0	N/A	N/A
	608,080	93	0.76
	608,080	93	127
	608,080	93	77
	608,080	264	52
	572,308	282	52
	493,910	286	1648
	78,398	284	357
	9,853	284	357
	493,930	586	1537
	65,031	284	357
	65,031	415	340
	30,010,000	75	15
	30,010,000	92	15
	85,000	60	25
	159,158	kW	
	90,031	kW	
	9,189	kW	
	240,000	kW	

Stream No.	Commodity	Location	Flow lb/hr	Temp. F	Pressure psia	Stream No	Commodity	Location	Flow lb/hr	Temp. F	Pressure psia
1	Air	Outside Air	3,356,789	80	14.70	40	Water	Blowdown from HP Evaporator	0	N/A	N/A
2	Air	Air at Outlet of Evaporative Cooler	3,368,338	66	14.70	41	Water	Blowdown from IP Evaporator	0	N/A	N/A
3	Air/Gas	Outlet of Gas Turbine	3,443,000	1113	15	42	Water	Blowdown from LP Evaporator	0	N/A	N/A
4	Exh. Gas	Stack	3,446,567	188	15	43	Water	Condenser Outlet, Condensate Pump Inlet	608,080	93	0.76
5	Nat. Gas	Natural Gas Supply to CTG (Note 2)	74,662	60	415	44	Water	Conensate Pump Outlet	608,080	93	127
6	Nat. Gas	Natural Gas Supply to Duct Burner (Note 3)	3,567	60	50	45	Not Used				
10	Not Used					46	Not Used				
11	Steam	LP Superheater Inlet	35,768	283	52	47	Water				
12	Steam	LP Superheater Outlet	35,768	474	48	48	Water	Condensate Preheater Inlet	608,080	93	77
13	Steam	IP Evaporator Outlet/ IP Superheater Inlet	65,031	429	339	49	Not Used				
14	Not Used					50	Water	Condensate Preheater Outlet	608,080	264	52
15	Not Used					51	Water	HP/IP Feedwater Pump Inlet	572,308	282	52
16	Steam	IP Superheater Outlet	65,031	540	312	52	Water	HP Feedwater Pump Outlet	493,910	286	1648
17	Steam	HP Superheater 1 Inlet/Hp Evaporator Outlet	493,930	600	1537	53	Water	IP Feedwater Pump Outlet	78,398	284	357
18	Not Used					54	Water	Spray Water To Desuperheater	9,853	284	357
19	Not Used					55	Not Used				
20	Steam	HP Steam Turbine Inlet	493,930	999	1413	56	Water	HP Evaporator Inlet/ HP Economizer Outlet	493,930	586	1537
21	Steam	HP Steam Turbine Outlet	478,610	644	324	57	Not Used				
22	Steam	Reheater Inlet	468,490	624	312	58	Not Used				
23	Not Used					59	Water	IP Economizer Inlet	65,031	284	357
24	Not Used					60	Water	IP Economizer Outlet/IP Evaporator Inlet	65,031	415	340
25	Steam	IP Steam Turbine Inlet	472,000	996	281	61	Not Used				
26	Not Used					62	Not Used				
27	Steam	IP Steam Turbine Outlet	487,310	538	43	63	Not Used				
28	Steam	LP Steam Turbine Inlet	523,080	533	43	64	Not Used				
29	Not Used					65	Not Used				
30	Not Used					71	Circ. Water	Condenser Inlet	30,010,000	75	15
31	Not Used					72	Circ. Water	Condenser Outlet	30,010,000	92	15
32	Steam	LP Steam Turbine Outlet/Condenser Inlet	523,080	93	0.76	73	Water	Makeup to Steam Cycle	85,000	60	25
33	Not Used					80	Not Used				
34	Not Used					81	Not Used				
35	Not Used					82	Not Used				
36	Not Used					90	Power	Gross Power Output, CTG	159,158	kW	
37	Steam	Process Steam Inlet to Desuperheater	75,147	644	324	91	Power	Gross Power Output, STG	90,031	kW	
38	Steam	Process Steam to Thermal Host	85,000	404	205		Power	Auxiliary Load	9,189	kW	
39	Not Used						Power	Net Plant Output	240,000	kW	

Notes:

1 Values shown above are based on computer model SFAFC0, dated 1/12/95, for "Operating Case" at 80 F and 40% RH ambient conditions, no CTG degradation.

2 Heat input to CTG is 1,452 MMBu/h (LHV) 1,611 MMBtu/h (HHV)

3 Heat input to duct burner is 72.8 MMBtu/h (LHV) 80.8 MMBtu/h (HHV)

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